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Langley Research Center

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NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

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- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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Introduction

Scientific and Technical Aerospace Reports (STAR) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces and disseminates both NASA's internal STI and world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up to date NASA STI, visit the STI Program's website at <http://www.sti.nasa.gov>.

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability'. When CASI is indicated, the user can order this information directly from CASI using the [STI Online Order Form](#) or contact help@sti.nasa.gov or telephone the CASI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI [documents](#) and [videos](#). When information is not available from CASI, the source of the information is indicated when known.

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

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The U.S. Congress established the **Federal Depository Library Program** (FDLP) to ensure access by the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal Depository Libraries http://www.access.gpo.gov/su_docs.

The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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[Subject Term Index](#)

[Personal Author Index](#)

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01

AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles see *12 Astronautics*.

20050199695 National Renewable Energy Lab., Golden, CO USA

Tower Design Load Verification on a 1-kW Wind Turbine

Huskey, A.; Prascher, D.; Nov. 2004; 14 pp.; In English

Report No.(s): DE2005-15011698; NREL/CP-500-37112; No Copyright; Avail: Department of Energy Information Bridge

Wind turbine testing at the National Wind Technology Center (NWTC) has been done to characterize both tower top loads and thrust loads for small wind turbines, which is part of an ongoing effort to model and predict small wind turbine behavior and the resulting stresses imposed on the supporting tower. To these ends, a 1-kW furling wind turbine mounted on a 10-meter tower was instrumented and monitored via a data acquisition system for nearly a year. This test was conducted to verify the design loads as predicted by the simple design equations provided in the draft revision of the International Electrotechnical Commission (IEC) Small Wind Turbine Safety Standard 61400-02 CDV (hereafter called 'the draft Standard'). Data were captured for several operating conditions covered by the draft Standard. This paper addresses the collected data and what conclusions can be made from it.

NTIS

Loads (Forces); Towers; Wind Turbines

20050199696 National Renewable Energy Lab., Golden, CO USA

Modern Control Design for Flexible Wind Turbines

Wright, A. D.; Jul. 2004; 238 pp.; In English

Report No.(s): DE2005-15011696; NREL/TP-500-35816; No Copyright; Avail: Department of Energy Information Bridge

Control can improve energy capture and reduce dynamic loads in wind turbines. In the 1970s and 1980s, wind turbines used classical control designs to regulate power and speed. The methods used, however, were not always successful. Modern turbines are larger, mounted on taller towers, and more dynamically active than their predecessors. Control systems to regulate turbine power and maintain stable, closed-loop behavior in the presence of turbulent wind inflow will be critical for these designs. This report applies modern state-space control design methods to a two-bladed teetering hub upwind machine at the National Wind Technology Center (NWTC), which is managed by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) in Golden, Colorado. The design objective is to regulate turbine speed and enhance damping in several low-damped flexible modes of the turbine. Starting with simple control algorithms based on linear models, complexity is added incrementally until the desired performance is firmly established.

NTIS

Damping; Design Analysis; Wind Turbines

20050199701 Airfoils, Inc., State College, PA, USA

Effect of Flap Deflection on Section Characteristics of S813 Airfoil. Period of Performance: 1993-1994

Somers, D. M.; Jan. 2005; 94 pp.; In English

Report No.(s): DE2005-15011677; No Copyright; Avail: Department of Energy Information Bridge

The effect of small deflections of a 30% chord, simple flap on the section characteristics of a tip airfoil, the S813, designed for 20- to 30-meter, stall-regulated, horizontal-axis wind turbines has been evaluated theoretically. The decrease in maximum

lift coefficient due to leading-edge roughness increases in magnitude with increasing, positive flap deflection and with decreasing Reynolds number.

NTIS

Airfoils; Deflection; Flapping; Reynolds Number; Surface Roughness; Wind Turbines

20050199703 Airfoils, Inc., State College, PA, USA

S819, and S820, and S821 Airfoils. (Report for October 1992-November 1993)

Somers, D. M.; Jan. 2005; 58 pp.; In English

Report No.(s): DE2005-15011676; No Copyright; Avail: Department of Energy Information Bridge

A family of thick airfoils for 10- to 20-meter, stall regulated, horizontal-axis wind turbines, the S819, S820, and S821, has been designed and analyzed theoretically. The primary objectives of restrained maximum lift, insensitive to roughness, and low profile drag have been achieved. The constraints on the pitching moments and airfoil thicknesses have been satisfied.

NTIS

Airfoils; Surface Roughness; Wind Turbines

20050199704 Airfoils, Inc., State College, PA, USA

S814 and S815 Airfoils. (Report for October 1991-July 1992)

Somers, D. M.; Dec. 2004; 48 pp.; In English

Report No.(s): DE2005-15011675; No Copyright; Avail: Department of Energy Information Bridge

Two thick laminar-flow airfoils for the root portion of a horizontal-axis wind turbine blade, the S814 and S815, have been designed and analyzed theoretically. For both airfoils, the primary objectives of high maximum lift, insensitive to roughness, and low profile drag have been achieved. The constraints on pitching moment and airfoil thicknesses have been satisfied.

NTIS

Surface Roughness; Wind Turbines; Windpower Utilization; Laminar Flow Airfoils

20050199705 Airfoils, Inc., State College, PA, USA

Design and Experimental Results for the S825 Airfoil. Period of Performance: 1998-1999

Somers, D. M.; Jan. 2005; 94 pp.; In English

Report No.(s): DE2005-15011673; No Copyright; Avail: Department of Energy Information Bridge

A 17%-thick, natural-laminar-flow airfoil, the S825, for the 75% blade radial station of 20- to 40-meter, variable-speed and variable-pitch (toward feather), horizontal-axis wind turbines has been designed and analyzed theoretically and verified experimentally in the NASA Langley Low-Turbulence Pressure Tunnel. The two primary objectives of high maximum lift, relatively insensitive to roughness and low-profile drag have been achieved. The airfoil exhibits a rapid, trailing-edge stall, which does not meet the design goal of a docile stall. The constraints on the pitching moment and the airfoil thickness have been satisfied. Comparisons of the theoretical and experimental results generally show good agreement.

NTIS

Airfoils; Surface Roughness; Wind Turbines

20050199706 Airfoils, Inc., State College, PA, USA

S829 Airfoil. Period of Performance: 1994-1995

Somers, D. M.; Jan. 2005; 40 pp.; In English

Report No.(s): DE2005-15011668; No Copyright; Avail: Department of Energy Information Bridge

A 16%-thick, natural-laminar-flow airfoil, the S829, for the tip region of 20- to 40-meter-diameter, stall-regulated, horizontal-axis wind turbines has been designed and analyzed theoretically. The two primary objectives of restrained maximum lift, insensitive to roughness, and low profile drag have been achieved. The constraints on the pitching moment and the airfoil thickness have been satisfied. The airfoil should exhibit a docile stall.

NTIS

Airfoils; Surface Roughness; Wind Turbines

20050199708 Airfoils, Inc., State College, PA, USA

Effects of Airfoil Thickness and Maximum Lift Coefficient on Roughness Sensitivity. Period of Performance: 1997-1998

Somers, D. M.; Jan. 2005; 134 pp.; In English

Report No.(s): DE2005-15011667; No Copyright; Avail: Department of Energy Information Bridge

A matrix of airfoils has been developed to determine the effects of airfoil thickness and the maximum lift to leading-edge roughness. The matrix consists of three natural-laminar-flow airfoils, the S901, S902, and S903, for wind turbine applications. The airfoils have been designed and analyzed theoretically and verified experimentally in the Pennsylvania State University low-speed, low-turbulence wind tunnel. The effect of roughness on the maximum lift increases with increasing airfoil thickness and decreases slightly with increasing maximum lift. Comparisons of the theoretical and experimental results generally show good agreement.

NTIS

Aerodynamic Coefficients; Airfoil Profiles; Lift; Sensitivity; Surface Roughness; Wind Turbines; Subsonic Wind Tunnels

20050199711 Airfoils, Inc., State College, PA, USA

S822 and S823 Airfoils

Somers, D. M.; Jan. 2005; 42 pp.; In English

Report No.(s): DE2005-15011666; No Copyright; Avail: Department of Energy Information Bridge

A family of thick airfoils for 3- to 10-meter, stall-regulated, horizontal-axis wind turbines, the S822 and S823, has been designed and analyzed theoretically. The primary objectives of restrained maximum lift, insensitive to roughness, and low profile have been achieved. The constraints on the pitching moments and airfoil thicknesses have been satisfied.

NTIS

Airfoils; Design Analysis; Wind Turbines

20050199716 National Renewable Energy Lab., Golden, CO USA

CondorNTM User's Guide

Moriarty, P.; Feb. 2005; 14 pp.; In English

Report No.(s): DE2005-15011461; NREL/TP-500-37254; No Copyright; Avail: Department of Energy Information Bridge

CondorNTM is similar to RunNTM in that it calculates a series of normal (or extreme) turbulence model simulations consistent with the International Electrotechnical Commission (IEC) design load cases. The major difference is that it employs the computational grid software Condor, which was developed by the University of Wisconsin. The advantage of using Condor is that many different computers connected on the network can be used simultaneously to calculate the various design load cases required by the IEC standard. This results in a large increase in computational resources proportional to the number of computers installed on the Condor grid.

NTIS

Computer Programs; Computers; Turbulence; Windpower Utilization

20050199718 National Renewable Energy Lab., Golden, CO USA

Wind Turbine Post-Stall Airfoil Performance Characteristics Guidelines for Blade-Element Momentum Methods

Tangler, J.; Kocurek, J. D.; Oct. 2004; 18 pp.; In English

Report No.(s): DE2005-15011699; NREL/CP-500-36900; No Copyright; Avail: Department of Energy Information Bridge

The objective of this study was to provide post-stall airfoil data input guidelines for the prediction of peak and post-peak rotor power when using blade-element momentum theory. A steady-state data set from the Unsteady Aerodynamic Experiment (UAE) rotor test was used to provide guidelines for the development of a global post-stall method for the prediction of post-stall 3-D airfoil characteristics to be used with 2-D airfoil data. Based on these UAE data, methods to emulate the 3-D aerodynamics in the post-stall region were explored. Also suggested are experimental tests needed to better understand the 3-D flow physics and to quantify needed theory or empirical factors for a global post-stall approach to support blade-element momentum methods.

NTIS

Airfoils; Momentum; Wind Turbines

20050199742 National Renewable Energy Lab., Golden, CO USA

Stability Analysis of an Adaptive Torque Controller for Variable Speed Wind Turbines

Johnson, K. E.; Pao, L. Y.; Balas, M. J.; Kulkarni, V.; Fingersh, L. J.; Dec. 2004; 16 pp.; In English

Report No.(s): DE2005-15011718; NREL/CP-500-36756; No Copyright; Avail: Department of Energy Information Bridge

Variable speed wind turbines are designed to follow wind speed variations in low winds in order to maximize aerodynamic efficiency. Unfortunately, uncertainty in the aerodynamic parameters may lead to sub-optimal power capture in variable speed turbines. Adaptive generator torque control is one method of eliminating this sub-optimality; however, before

adaptive control can become widely used in the wind industry, it must be proven to be safe. This paper analyzes the stability of an adaptive torque control law and the gain adaptation law in use on the Controls Advanced Research Turbine (CART) at the National Renewable Energy Laboratory's National Wind Technology Center.

NTIS

Adaptive Control; Aerodynamics; Stability Tests; Torque; Wind Turbines

20050201680 NASA, Washington, DC, USA

The Future of Flight

Springer, Anthony M.; Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight; August 2003, pp. 155-181; In English; See also 20050201673; Copyright; Avail: Other Sources

This paper presents viewgraphs on supersonic transports, hypersonic planes, runway-independent aircraft, and small personal aircraft which are possibilities for the aircraft of the future.

Author

Space Flight; Aerospace Engineering; Aeronautics

02

AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20050199461 NASA Glenn Research Center, Cleveland, OH, USA

Abe Silverstein 10- by 10-Foot Supersonic Wind Tunnel Validated for Low-Speed (Subsonic) Operation

Hoffman, Thomas R.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center and Lockheed Martin Corporation tested an aircraft model in two wind tunnels to compare low-speed (subsonic) flow characteristics. Objectives of the test were to determine and document the similarities and uniqueness of the tunnels and to validate that Glenn's 10- by 10-Foot Supersonic Wind Tunnel (10x10 SWT) is a viable low-speed test facility. Results from two of Glenn's wind tunnels compare very favorably and show that the 10x10 SWT is a viable low-speed wind tunnel. The Subsonic Comparison Test was a joint effort by NASA and Lockheed Martin using the Lockheed Martin's Joint Strike Fighter Concept Demonstration Aircraft model. Although Glenn's 10310 and 836 SWT's have many similarities, they also have unique characteristics. Therefore, test data were collected for multiple model configurations at various vertical locations in the test section, starting at the test section centerline and extending into the ceiling and floor boundary layers.

Derived from text

Supersonic Wind Tunnels; Wind Tunnel Models

20050200839 HyPerComp, Inc., Westlake Village, CA USA

Automated Design Optimization for Hypersonic Plasma-Aerodynamics

Munipalli, Ramakanth; Subbarao, Kamesh; Aithal, Shashi; Wilson, Donald R.; Goss, Jennifer D.; Jun. 2005; 71 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0117

Report No.(s): AD-A435356; AFRL-SR-AR-TR-05-0265; No Copyright; Avail: CASI; [A04](#), Hardcopy

In the first part we present our ongoing work on the optimization of an MHD energy by-pass concept. Here we consider the optimization of the power generator and accelerator components individually, and are in the process of a simultaneous optimization of an integrated generator-combustor-accelerator concept in a 2-D sense. We have concentrated our efforts on developing an optimization scheme that couples a flow solver (perfect gas Euler and equilibrium gas N-S) with a Poisson solver for the electric field including Hall effects. The architecture/algorithm of the optimization scheme is such that geometric and/or physical parameters can be optimized for a given set of free-stream conditions and objective function. The objective function was MHD power extracted in the case of a MHD generator, and thrust in the case of an accelerator. The second part of this report presents some ideas on how to extend this development and the associated real-gas MHD technology at HyPerComp Inc. into a potential Phase-II. We have developed a higher (4% order and beyond,) order accurate solver for MHD developed under an AFRL contract. We consider possibilities involving the usage of this solver in accurate boundary layer

calculations and plasma effects in shear layers as a potential Phase-II extension. The current study of energy bypass concepts may itself be extended into an extensive exploration of finite rate processes in such systems coupled with an efficient optimization routine based on adjoint methods. A masters thesis supported in part by this contract on the optimization problem setup for hypersonic inlets to improve mass capture has been completed. Relevant portions of this thesis have been appended to this report in the third part.

DTIC

Aerodynamics; Design Optimization; Hypersonics; Magnetohydrodynamics; Plasmas (Physics)

20050200881 Naval Postgraduate School, Monterey, CA USA

Attitude Determination for the Three-Axis Spacecraft Simulator (TASS) by Application of Particle Filtering Techniques

Kassalias, Ioannis; Jun. 2005; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435493; No Copyright; Avail: Defense Technical Information Center (DTIC)

The accurate determination of spacecraft attitude has always been a critical issue in many applications. The presence of imperfect sensors introduces errors in the system and affects the outcome of the mission. One of the most significant sensors is the rate gyroscope. Particularly, the rate gyros are known to degrade with time, introducing random noise and bias. This calls for estimation algorithms which process the measured data in order to reduce the effects of the disturbances to a minimum. This research presents an approach which takes full advantage on the nonlinear dynamics and possibly non-Gaussian disturbances. It is based on recent work involving particle filters, where the probability density functions are approximated by a relatively large number of parameters. It is shown that accurate attitude estimation can be obtained with a manageable number of particles.

DTIC

Attitude (Inclination); Simulators

20050200903 Naval Postgraduate School, Monterey, CA USA

Impact of Leading-Edge Orientation and Shape on Performance of Compressor Blades

Powell, Jonathan D.; Jun. 2005; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435538; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis presents a Computation Fluid Dynamics (CFD) analysis of the aerodynamic performance of circular and elliptical leading edges of compressor blades, with a range of leading edge droop angles. Specifically, simulations were conducted, with a free stream Mach number of 0.65 to quantify the change in pressure distributions and boundary layer momentum thickness in the leading-edge region for a range of incidences on a flat plate with various leading-edge ellipticity ratios, ranging from unity (circular) to 5.5. In addition, the impact of drooping the leading edge was analyzed over a range of incidence angles from zero to 13 degrees. Pressure distributions indicate that elliptical leading edges can eliminate separation bubbles at zero incidence. The results indicated that the minimum loss occurred at an ellipticity ratio of about 3.5 and elliptical leading edges with a droop slightly greater than the average incidence can significantly decreased aerodynamic losses over a wider range of incidences.

DTIC

Aerodynamics; Compressor Blades; Computational Fluid Dynamics; Leading Edges; Shapes

20050201957 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China

Transactions of Nanjing University of Aeronautics and Astronautics, Vol 22, No. 1, March 2005

Dewang, L.; Mar. 2005; 94 pp.; In English

Report No.(s): PB2005-107474; No Copyright; Avail: CASI; [A05](#), Hardcopy

;Contents: Large-Eddy Simulation of Two-Phase Reacting Flow in Model Combustor; Prediction of Rime Ice Accretion and Resulting Effect on Airfoil Performance; Multi-Agent Based Distributed Manufacturing Execution System Model; Contour Extraction and Feature Point Detection for 3-D Fragment Reassembly; Checking Consistency in Information Models by Using Constraint Programming; Dynamic Engineering Document Management Based on XML Technology; Internet-Based Machining Parameter Optimization and Management System for High-Speed Machining; Cutting Temperature Measurement in High-Speed End Milling; Speeding-Up Re-sampled Algorithm in Ray Casting Volume Rendering of Medical Images; Autonomous Agent Framework and Its Decision-Making; TVD Scheme with Chemical Reaction Flow and Its Application in

Combustion Gas Jetting Flow; Route Optimizing Algorithm of Airport Surface Based on GIS; Hierarchic Grey Quasi-Preferred Analysis Model and Its Application.

NTIS

Large Eddy Simulation; Two Phase Flow; Engineering Management; Chemical Reactions

20050201959 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China

Journal of Nanjing University of Aeronautics and Astronautics, Volume 37, No. 2

Dewang, L.; Apr. 2005; 144 pp.; In Chinese

Report No.(s): PB2005-107472; Copyright; Avail: National Technical Information Service (NTIS)

;Partial Contents: Generalized Dynamic Wake Model Applied to Helicopter Pitching and Rolling Maneuver; Active Damping with Adaptive Feedback Control in Time Domain for Dynamical Systems with Light Dan; Contact Process and Friction Analysis of Linear Ultrasonic Motor; Penalty Function Method Applied to Numerical Aerodynamic Optimization; Simulation of Hypersonic Non Equilibrium Flow Using Hybrid Grids; Unstructured Grid Generation Algorithm and Its Numerical Simulations; Grid Generation Method Using Prescribed Mesh Modules; Analysis of Boundary Layer Stability for Non-Parallel Flow with Pressure Gradient; Longitudinal Flight Control and Guidance Law Design for Trans-aerosphere Vehicle; Calculation of Three-Dimensional Rotational Effect on Blade Aerodynamic Characteristics; Direct Control of Aeroengine Thrust Based on Correlation Analysis and Neural Networks; Numerical Simulations of Energy Absorption Capability of Composite Components.

NTIS

Adaptive Control; Longitudinal Control; Hypersonic Flow; Aerodynamic Characteristics; Dynamic Models; Energy Absorption

20050201960 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China

Journal of Nanjing University of Aeronautics and Astronautics, Volume 37, Number 3, June 2005

Dewang, L.; Jun. 2005; 142 pp.; In Chinese

Report No.(s): PB2005-107473; Copyright; Avail: National Technical Information Service (NTIS)

Partial Contents: 3D Visualization Simulation System Based on OpenGL of Low Altitude Chase/Interception; Fuzzy Damped Algorithm in Strapdown Attitude Heading Reference System; State Observer Design for a Class of Nonlinear Systems with Modelling Uncertainty; Fault Detection for Uncertain Nonlinear System Based on Unknown Input Observer; Stabilizer Bar Modeling of Small-Size Unmanned Helicopter and Attitude Control System Design; Fuzzy Adaptive Tracking Control for a Class of Nonlinear Systems; New Spatial Multi Dimensional Association Rule Model and Its Algorithm; Multi-Scale Edge Detection Algorithm for Magnetic Resonance Images; Automated Contour Detection for Intravascular Ultrasound Image Sequences; Image Classification Using Compressed Histograms; Study on SAR Raw Data Compression Techniques; Novel Real-Time Registration Algorithm for Radar Networking; Algorithm of Direction Finding for Broadband Digital Signal; Size Distribution Measurement of Coal Particles in Two-Phase Flows; Analysis and Simulation of Electric Power Drive System in Helicopter Rotor Test Bed; Analysis on Control Strategy 11 for Doubly Salient Permanent Magnet Motor; Novel High-Frequency Output ZVS Inverter.

NTIS

Two Phase Flow; Control Systems Design; Attitude Control; Fault Detection; Strapdown Inertial Guidance

20050203848 NASA Glenn Research Center, Cleveland, OH, USA

NASA's Proposed Requirements for the Global Aeronautical Network and a Summary of Responses

Ivancic, William D.; July 2005; 12 pp.; In English; Fifth Integrated Communications Navigation and Surveillance (ICNS) Conference and Workshop, 2-5 May 2005, Fairfax, VA, USA

Contract(s)/Grant(s): WBS 22-184-10-06

Report No.(s): NASA/TM-2005-213831; E-15201; No Copyright; Avail: CASI; [A03](#), Hardcopy

In October 2003, NASA embarked on the ACAST project (Advanced CNS Architectures and System Technologies) to perform research and development on selected communications, navigation, and surveillance (CNS) technologies to enhance the performance of the National Airspace System (NAS). The Networking Research Group of NASA's ACAST project, in order to ensure global interoperability and deployment, formulated their own salient list of requirements. Many of these are not necessarily of concern to the FAA, but are a concern to those who have to deploy, operate, and pay for these systems. These

requirements were submitted to the world's industries, governments, and academic institutions for comments. The results of that request for comments are summarized in this paper.

Author

Aeronautics; NASA Programs; Communication Networks; Requirements

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20050200933 Naval Postgraduate School, Monterey, CA USA

Time-Optimization of High Performance Combat Maneuvers

Carter, Benjamin R.; Jun. 2005; 243 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435593; No Copyright; Avail: Defense Technical Information Center (DTIC)

Recent developments in post-stall maneuverability and thrust vectoring have opened up new possibilities in the field of air combat maneuvering. High angle of attack maneuvers like the Cobra, Herbst Reversal, and Chakra demonstrate that today's cutting edge fighters are capable of exploiting the post-stall flight regime for very dynamic and unconventional maneuvers. With the development and testing of Unmanned Combat Aerial Vehicles, even greater maneuvering ability is expected. However, little work has been done to make use of this increased ability by optimizing a wide range of combat maneuvers. The goal of this thesis was to begin that process by finding several time-optimal air combat maneuvers that could be employed by current and future high performance fighter aircraft.

DTIC

Combat; Warfare

20050200985 Naval Postgraduate School, Monterey, CA USA

Supply and Demand for Business Education in Naval Aviation

Gray, Obra L.; Jun. 2005; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435692; No Copyright; Avail: Defense Technical Information Center (DTIC)

In light of the Navy's transformation plan, advanced business education is increasing in importance. As part of the Navy's Sea Power 21 strategy Sea Enterprise encourages Naval Aviation to steer historical management practices towards better business practices. As pilots and Naval Flight Officers evolve from Mission Commander to Commanding Officer, they must be equipped with the requisite business skill sets to engage the challenge of balancing aircraft modernization with current readiness. This project analyzes the supply and demand for postgraduate business education to determine how prepared Naval Aviation is to achieve long-term transformation objectives. The results show that 25 percent of all aviation officers (O-1 to O-6) have a graduate business degree, 17 percent of Commanding Officers with advanced degrees have a business specialization, and 2.5 percent of aviation officer billets require a postgraduate business degree. Recommendations to better prepare the aviation community for the Sea Enterprise environment include: (1) Early emphasis of graduate business education, (2) Promote advanced business education as a major career milestone, (3) Tie first shore tour assignments to graduate business education, and (4) Increase the overall billet requirement for advanced business degrees. These improvements may greatly enhance the Navy's efforts towards achieving its transformation goals.

DTIC

Commerce; Demand (Economics); Education; Military Aviation; Supplying

20050201013 Naval Postgraduate School, Monterey, CA USA

Commander Naval Air Forces (CNAF) Flight Hour Program: Budgeting and Execution Response to the Implementation of the Fleet Response Plan and OP-20 Pricing Model Changes

Glenn, Walter H., Jr.; Otten, Eric E.; Jun. 2005; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435740; No Copyright; Avail: Defense Technical Information Center (DTIC)

Effectively managing the Navy Flight Hour Program (FHP) has historically posed unique challenges. Most notably, CNAF FHP managers have routinely faced a seemingly unavoidable shortfall in flight hour funding requiring the use of creative cash management practices and reliance on defense supplemental appropriations to continue flight operations to the

end of each fiscal year. In an effort to reduce this disparity between budget forecasts and actual program execution requirements, significant changes were recently made to individual pricing models used in formulating OP-20 funding levels. In addition, the Navy's transition to the Fleet Readiness Training Plan (FRTP) in support of the overall Fleet Response Plan (FRP) in July of 2003 resulted in a fundamental shift in funding level requirements and overall program execution. The purpose of this study is to analyze what effect the response to this fundamental shift in the Navy's overall readiness posture, in conjunction with the aforementioned OP-20 budgetary process enhancements, had on the matching of budgeted program dollars with execution requirements. The methodology for the study will entail an analysis into the specific changes to the budgeting models used in the formulation of OP-20 funding levels, along with a review of the resulting execution changes at COMNAVAIRPAC (CNAP) in support of the FRP.

DTIC

Budgeting; Military Aviation

20050201606 Army Missile Command, Fort Eustis, VA USA

Testing of Mylar Tear-Off Windshield Film for Aircraft

Bordick, Nathaniel E.; Robeson, Mark E.; May 2005; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435390; RDECOM/AATD-05-D-32; No Copyright; Avail: Defense Technical Information Center (DTIC)

In an effort to combat windscreen erosion on Army aircraft, a Mylar film has been developed to apply directly to the environmentally exposed surface of windscreens. This film can be applied to aircraft windscreens in single or multiple layer sheets, which once removed will leave no permanent residue on the underlying surface. A qualitative evaluation of Mylar Tear-Off Windshield Film (MTOWF) has been conducted, and indicates that MTOWF is appropriate for Army aircraft application. For example, the testing showed that the installation, cleaning, and removal of MTOWF are quick and easy. In addition, the optical qualities of MTOWF and its resistance to damage and delamination are sufficient for Army aircraft use. Finally, testing showed that MTOWF does not hinder night vision goggle performance and that any electrostatic build-up issues can be overcome. MTOWF protects the windscreen, prolonging its operating life and ultimately increasing aircraft readiness. By protecting the windscreen, MTOWF will save the Government Operations and Support (O&S) costs, since it is much cheaper and quicker to replace MTOWF than to replace a windscreen.

DTIC

Mylar (Trademark); Windshields

20050201950 Federal Aviation Administration, Washington, DC USA

Terminal Area Forecast Summary, Fiscal Years 2004-2020

January 2004; 52 pp.; In English

Report No.(s): PB2005-108487; FAA-APO-05-1; No Copyright; Avail: CASI; [A04](#), Hardcopy

This publication provides aviation data users with summary historical and forecast statistics on passenger demand and aviation activity at U.S. airports. The summary level forecasts are based on individual airport projections.

NTIS

Charts; Forecasting

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20050199656 NASA Langley Research Center, Hampton, VA, USA

A Method to Analyze Tail Buffet Loads of Aircraft

Pototzky, Anthony S.; Moses, Robert W.; [2005]; 14 pp.; In English; RTO/AVT-123: Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary; Original contains color illustrations

Contract(s)/Grant(s): 23-745-45-43

Report No.(s): RTO-MP-AVT-123; Paper 19-1; No Copyright; Avail: CASI; [A03](#), Hardcopy

Aircraft designers commit significant resources to the design of aircraft in meeting performance goals. Despite fulfilling traditional design requirements, many fighter aircraft have encountered buffet loads when demonstrating their high angle-of-attack maneuver capabilities. As a result, during test or initial production phases of fighter development programs,

many new designs are impacted, usually in a detrimental way, by resulting in reassessing designs or limiting full mission capability. These troublesome experiences usually stem from overlooking or completely ignoring the effects of buffet during the design phase of aircraft. Perhaps additional requirements are necessary that addresses effects of buffet in achieving best aircraft performance in fulfilling mission goals. This paper describes a reliable, fairly simple, but quite general buffet loads analysis method to use in the initial design phases of fighter-aircraft development. The method is very similar to the random gust load analysis that is now commonly available in a commercial code, which this analysis capability is based, with some key modifications. The paper describes the theory and the implementation of the methodology. The method is demonstrated on a JSF prototype example problem. The demonstration also serves as a validation of the method, since, in the paper, the analysis is shown to nearly match the flight data. In addition, the paper demonstrates how the analysis method can be used to assess candidate design concepts in determining a satisfactory final aircraft configuration.

Author

Gust Loads; Buffeting; Fighter Aircraft; Aircraft Design; Angle of Attack; Random Loads

20050199681 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Safety Report: Current Procedures for Collecting and Reporting U.S. General Aviation Accident and Activity Data

Apr. 29, 2005; 40 pp.; In English

Report No.(s): PB2005-917002; NTSB/SR-05/02; No Copyright; Avail: CASI; [A03](#), Hardcopy

Unlike Part 121 and scheduled Part 135 air carriers, general aviation operators and on-demand Part 135 operators (air taxis) are not required to report actual flight activity data to DOT. Instead, the Federal Aviation Administration (FAA) uses its annual General Aviation and Air Taxi Activity (GAATA) Survey to query a sample of registered aircraft owners, either through the Internet or by mail. The National Transportation Safety Board and others rely on GAATA Survey activity estimates to calculate accident rates and statistics that for the basis for assessing general aviation safety in the USA. Congress, government agencies, the aviation industry, and other researchers frequently cite accident rates when evaluating the need for safety initiatives. Valid activity data are necessary to compare the accident rates for different aircraft types and types of operations, to establish baseline measures that can be used to identify and track accident trends, and to assess the effectiveness of safety improvement efforts. Because of a critical need for accurate activity measures, and the perception of possible problems with current general aviation activity estimates, the Safety Board analyzed several general aviation exposure measures to determine the relationship of trends over time. The results of that analysis are included in this report. One existing recommendation to the FAA is superseded in this report, two new recommendations are issued, and two existing recommendations are reiterated.

NTIS

Aircraft Accidents; Aircraft Safety; Collection; Flight Safety; General Aviation Aircraft; Safety; Safety Management; Transportation

20050199730 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Engine Cycles Analyzed for Turbofans With Variable-Area Fan Nozzles Actuated by a Shape Memory Alloy

Berton, Jeffrey J.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Advanced, large commercial turbofan engines using low-fan-pressure-ratio, very high bypass ratio thermodynamic cycles can offer significant fuel savings over engines currently in operation. Several technological challenges must be addressed, however, before these engines can be designed. To name a few, the high-diameter fans associated with these engines pose a significant packaging and aircraft installation challenge, and a large, heavy gearbox is often necessary to address the differences in ideal operating speeds between the fan and the low-pressure turbine. Also, the large nacelles contribute aerodynamic drag penalties and require long, heavy landing gear when mounted on conventional, low wing aircraft. Nevertheless, the reduced fuel consumption rates of these engines are a compelling economic incentive, and fans designed with low pressure ratios and low tip speeds offer attractive noise-reduction benefits. Another complication associated with low-pressure-ratio fans is their need for variable flow-path geometry. As the design fan pressure ratio is reduced below about 1.4, an operational disparity is set up in the fan between high and low flight speeds. In other words, between takeoff and cruise there is too large a swing in several key fan parameters-- such as speed, flow, and pressure--for a fan to accommodate. One solution to this problem is to make use of a variable-area fan nozzle (VAFN). However, conventional, hydraulically actuated variable nozzles have weight, cost, maintenance, and reliability issues that discourage their use with low-fan-pressure-ratio engine cycles. United Technologies Research, in cooperation with NASA, is developing a revolutionary, lightweight, and reliable shape memory alloy actuator system that can change the on-demand nozzle exit area by up to 20 percent. This 'smart material' actuation technology, being studied under NASA's Ultra-Efficient Engine Technology (UEET) Program and

Revolutionary Concepts in Aeronautics (RevCon) Program, has the potential to enable the next generation of efficient, quiet, very high bypass ratio turbofans. NASA Glenn Research Center's Propulsion Systems Analysis Office, along with NASA Langley Research Center's Systems Analysis Branch, conducted an independent analytical assessment of this new technology to provide strategic guidance to UEET and RevCon. A 2010-technology-level high-spool engine core was designed for this evaluation. Two families of low-spool components, one with and one without VAFN's, were designed to operate with the core. This 'constant core' approach was used to hold most design parameters constant so that any performance differences between the VAFN and fixed nozzle cycles could be attributed to the VAFN technology alone. In this manner, the cycle design regimes that offer a performance payoff when VAFN's are used could be identified. The NASA analytical model of a performance-optimized VAFN turbofan with a fan pressure ratio of 1.28 is shown. Mission analyses of the engines were conducted using the notional, long-haul, advanced commercial twinjet shown. A high wing design was used to accommodate the large high-bypassratio engines. The mission fuel reduction benefit of very high bypass shape-memory-alloy VAFN aircraft was calculated to be 8.3 percent lower than a moderate bypass cycle using a conventional fixed nozzle. Shape-memory-alloy VAFN technology is currently under development in NASA's UEET and RevCon Programs.

Author

Engine Design; Shape Memory Alloys; Turbofan Engines; Nozzle Design; Aircraft Design; Mathematical Models; Technology Utilization; Actuators

20050200866 Defense Acquisition Univ., Fort Belvoir, VA USA

Military Aircraft, the F/A-18E/F Super Hornet Program: Background and Issues for Congress

Bolkcom, Christopher; Apr. 2004; 21 pp.; In English

Report No.(s): AD-A435448; No Copyright; Avail: Defense Technical Information Center (DTIC)

The F/A-18E/F Super Hornet is described by some as the latest version of the Navy's carrier-based F/A-18 fighter/attack plane, with more range/payload and better avionics and weapons than the A/B and C/D models. Other's describe the Super Hornet as an entirely new aircraft. The F/A-18E/F entered production in FY1997 to replace current F/A-18s as well as other carrier-based planes. In the early 1990s, the Navy's plans for modernizing carrier aviation included the upgraded F/A-18E/F and a projected AFX- aircraft that was later canceled. As the only current aircraft program for modernizing Navy fighter and attack capabilities, the F/A-18E/F is considered critical to the future of naval aviation. Whether this program was the most cost-effective way to modernize naval aviation has been questioned. Proposed alternatives to the F/A-18E/F have included developing a fighter/attack version of the F-14 fighter, continued use of the F/A-18C/D version, or increased procurement of the Joint Strike Fighter when it is fielded. In May 1997, the Defense Department recommended procurement of between 548 and 785 F/A-18E/Fs instead of the 1,000 aircraft projected originally. A 462- plane program (not including 90 EA-18Gs) was estimated in December 2003 to cost about \$43.57 billion in current-year dollars.

DTIC

Fighter Aircraft; Jet Aircraft; Military Aircraft; Military Aviation

20050200915 Naval Postgraduate School, Monterey, CA USA

High Energy Solid State and Free Electron Laser Systems in Tactical Aviation

Mansfield, Robb P.; Jun. 2005; 100 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435562; No Copyright; Avail: Defense Technical Information Center (DTIC)

A study and analysis of high energy laser (HEL) systems aboard tactical aircraft is performed. The FA-18E/F Hornet and F-35 Joint Strike Fighter (JSF), equipped with solid-state HEL systems, are the main subjects of the study. Considerations of power generation and thermal management for a fighter-sized HEL system and aero-optic effects on beam propagation from high and medium altitude platforms are examined. An overview of system capabilities details how the HEL system will be more difficult to incorporate into legacy strike aircraft, but may be feasible for future aircraft such as the JSF. Tactical flight simulations are used to study and develop potential concepts of operation (CONOPS), using realistic scenarios and threat environments. Results show that a tactical HEL will not be a stand-alone weapon in combat, but will have many potentially useful tactical applications. Another study of a high energy free electron laser (FEL) system aboard a C-130J-30 Hercules shows that such a system is feasible. Finally, a study of the FEL shows that strong field extraction can be optimized using undulator tapering.

DTIC

Free Electron Lasers; High Power Lasers; Solid State; Solid State Lasers

20050200919 Naval Postgraduate School, Monterey, CA USA

CAS, Interdiction, and Attack Helicopters

Groenke, Andrew S.; Jun. 2005; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435566; No Copyright; Avail: Defense Technical Information Center (DTIC)

Within days of a major failed strike by attack helicopters during Operation Iraqi Freedom (OIF) analysts were questioning the value of such platforms on the modern battlefield. As OIF moved from combat to stability operations, helicopter losses from enemy action actually increased seemingly strengthening the argument of those who see the helicopter as suitable to some combat operations. Attack helicopter operations have diverged into two distinct categories, interdiction and close air support (CAS), since their inception. This thesis argues that attack helicopters are most suited to perform CAS while their employment in interdiction is problematic at best. Doctrine, tactics, and threat are studied as they applied in the Soviet-Afghan War, Desert Storm, and OIF in order to examine the issue across a range of time and types of warfare.

DTIC

Attack Aircraft; Military Helicopters; Military Operations; Support Systems

20050200941 Defense Acquisition Univ., Fort Belvoir, VA USA

Military Airlift: C-17 Aircraft Program

Bolkcom, Christopher; Apr. 2004; 24 pp.; In English

Report No.(s): AD-A435617; CRS-RL30685; No Copyright; Avail: Defense Technical Information Center (DTIC)

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. Congress approved development of the aircraft in the late 1970s, when it was recognized that the Air Force did not have enough airlift capability. In 1981, the McDonnell Douglas C-17 emerged as winner of a competition with Boeing and Lockheed to develop a next-generation aircraft to replace C-130s and C-141s. Full-scale development of the C-17 got underway in 1986, but technical problems and funding shortfalls delayed the program, leading to slipped schedules and increased costs. Despite those difficulties, the C-17 has retained broad congressional support and enjoys strong Air Force and Army backing. Defense officials view the C-17 as essential in the post-Cold War environment, because of its ability to fly long distances with large payloads yet still use smaller bases in remote areas. The C-17 first flew in 1991, about a year later than originally scheduled. Deliveries began in 1993, and in January 1995, the Air Force declared the aircraft fully operational. C-17s have been successfully used in Bosnia, Kosovo, Afghanistan and other operations. The current inventory of C-17s is 100 aircraft.

DTIC

C-17 Aircraft; Transport Aircraft

20050200942 Defense Acquisition Univ., Fort Belvoir, VA USA

V-22 Osprey Tilt-Rotor Aircraft

Bolkcom, Christopher; Apr. 2004; 24 pp.; In English

Report No.(s): AD-A435618; CRS-RL31384; No Copyright; Avail: Defense Technical Information Center (DTIC)

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies like a plane by tilting its wing-mounted rotors to function as propellers. Combining a helicopter's operational flexibility with the greater speed, range, and efficiency of fixed-wing aircraft, the V-22 can perform such missions as troop/cargo transport, amphibious assault, special operations, and search and rescue operations. Begun in FY1982 by the Army and now funded in part by the Air Force, the V-22 has been primarily a Marine Corps program funded by the Navy Department. The aircraft is produced by Bell Helicopter Textron and Boeing Helicopters, with engines produced by Rolls-Royce/Allison. Flight testing and operational evaluation of pre-production V-22s began in early 1997, with procurement of production aircraft approved in April 1997. The future of the aircraft was at issue in 1989-92, when Secretary of Defense Cheney sought to cancel the program on grounds of affordability. Congress continued to fund the program, however, providing \$16.4 billion through FY2004. As of December 31, 2003, the Defense Department estimated the program's total cost to be about \$48 billion to develop and produce 458 aircraft.

DTIC

Tilt Rotor Aircraft; V-22 Aircraft

20050200948 Defence Science and Technology Organisation, Victoria, Australia

Modelling of Thermal Line Scanning for the Inspection of Delamination in Composites and Cracking in Metals

Rajic, N.; Dec. 2004; 31 pp.; In English

Report No.(s): AD-A435630; DSTO-TR-1673; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report describes a predictive capability, comprising analytical and numerical models, for the development and assessment of thermal line-scanning, an emerging non-destructive technique for the rapid inspection of aircraft structural components. The models describe the two-dimensional heat diffusion process pertaining to the application of a thermal line source to an object moving at constant velocity. Relevant case studies are considered including delamination in a composite laminate and cracking in a metal plate. Numerical experiments show that for planar flaws aligned with the inspection surface the performance of thermal line scanning is broadly equivalent to that of conventional flash thermography. In contrast, for a surface-breaking crack, where the flaw plane is typically perpendicular to the scan direction, strong lateral heat flows induced by a narrow beam provide a superior basis for inspection. For problems that involve distributed cracking, like in the wing carry-through bulkhead in the F/A-18 aircraft, the technique could offer an advantage over more conventional methods of inspection.

DTIC

Composite Materials; Cracks; Delaminating; Inspection; Mathematical Models; Metals; Thermodynamic Properties

20050200973 Naval Postgraduate School, Monterey, CA USA

Swarm Intelligence for Autonomous UAV Control

Frantz, Natalie R.; Jun. 2005; 131 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435664; No Copyright; Avail: Defense Technical Information Center (DTIC)

Unmanned Aerial Vehicles (UAVs) are becoming vital warfare platforms because they significantly reduce the risk of human life while accomplishing important missions. A UAV can be used for example, as stand-in sensor for the detection of mobile, low-probability-of-intercept battlefield surveillance and fire control emitters. With many UAVs acting together as a swarm, the location and frequency characteristics of each emitter can be accurately determined to continuously provide complete battlefield awareness. The swarm should be able to act autonomously while searching for targets and relaying the information to all swarm members. In this thesis, two methods of autonomous control of a UAV swarm were investigated. The first method investigated was the Particle Swarm Optimization (PSO) algorithm. This technique uses a non-linear approach to minimize the error between the location of each particle and the target by accelerating particles through the search space until the target is found. When applied to a swarm of UAVs, the PSO algorithm did not produce the desired performance results. The second method used a linear algorithm to determine the correct heading and maneuver the swarm toward the target at a constant velocity. This thesis shows that the second approach is more practical to a UAV swarm. New results are shown to demonstrate the application of the algorithm to the swarm movement.

DTIC

Automatic Control; Autonomy; Intelligence; Nonlinear Systems; Pilotless Aircraft; Remotely Piloted Vehicles

20050200981 Naval Postgraduate School, Monterey, CA USA

Integration of Mini-UAVs at the Tactical Operations Level: Implications of Operations, Implementation, and Information Sharing

Crouch, Collier C.; Jun. 2005; 199 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435680; No Copyright; Avail: Defense Technical Information Center (DTIC)

Small units maneuvering on the battlefield have little time to establish data links and interface with the Global Information Grid (GIG) while trying to achieve an objective. The bandwidth and interface requirements necessary to receive live data from current strategic level systems limit the small unit operational user's ability to receive and act upon data and intelligence. Without the ability to interface with current strategic-level UAV assets, these small units are left without a comprehensive operational picture. Mini-UAVs offer the capability for the tactical user, in a variety of missions, to have direct control over the aerial asset without intervention from higher authority. Organic UAV assets can be used to collect data relevant to small units without the need for connecting to intelligence systems. This offers increased mobility and a dedicated collection platform; however, there are still drawbacks to this capability. This thesis examines mini-UAVs, and their integration into the Coalition Operating Area Surveillance and Targeting System (COASTS) network.

DTIC

Aircraft; Reconnaissance; Surveillance; Warfare

20050201010 Defense Acquisition Univ., Fort Belvoir, VA USA

The Air Force KC-767 Tanker Lease Proposal: Key Issues for Congress

Bolkcom, Christopher; Sep. 2003; 87 pp.; In English

Report No.(s): AD-A435734; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Air Force wishes to replace its KC-135E aircraft by leasing 100 new Boeing KC-767 tankers. The Air Force indicates that leasing is preferred because it will result in faster deliveries than outright purchasing. Air Force leaders argue that a lease will allow them to husband scarce procurement dollars by making a small down payment. Although Congress authorized the proposed lease in the FY2002 DOD Appropriations Act, it stipulated that the defense oversight committees must approve the lease only the Senate Armed Services Committee has yet to approve. The lease proposal has been controversial and issues raised thus far include: Whether there is an urgent need to replace the KC-135-135 fleet. The Air Force states that replacing the KC-135 is urgent, citing high costs, aircraft vulnerability to catastrophic problems, and the imminent closing of the 767 production line. Opponents of the lease state that operating costs are controllable and will be far lower than the overall costs of leasing the 767; that the vulnerability is no more than depicted in a 2-year old study which the Air Force found acceptable; and that the 767 production line is viable until 2006-2008. Whether the KC-767 is the right airplane. If acquired, the KC-767 may be in DoD's inventory for 50 years. The Air Force says that the KC-767 is much more capable than the KC-135. Opponents say that other aircraft are even better than the KC-767 in meeting the Air Force's requirements. The Air Force opposes re-engining KC-135Es, but opponents say it merits attention, as does outsourcing aerial refueling.

DTIC

Government Procurement; Tanker Aircraft

20050201016 Naval Postgraduate School, Monterey, CA USA

Enhancing the Extended Awareness Capability of the ESG: Integrating Shotspotter and Cursor on Target Technologies with Unmanned Aerial Vehicles to Enhance the Mission Capability of the ESG

Schaeffer, Kevin M.; Gibbons, Thomas J., Jr; Jun. 2005; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435746; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis discusses two emerging technologies and how their integration with UAVs can improve the situational awareness capability of the Expeditionary Strike Group. Shotspotter is an acoustic gunshot detection system and Cursor on Target is an XML based schema to enhance information exchanges. When integrated with UAVs, these two technologies will drastically improve an ESG's efficiency and lethality in combat.

DTIC

Aircraft; Electrostatic Gyroscopes; Pilotless Aircraft; Sound Detecting and Ranging; Targets

20050201020 Massachusetts Inst. of Tech., Cambridge, MA USA

Report on the AFOSR Workshop on UAV Testbeds and Simulations

How, Jonathan; Jan. 2005; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0405

Report No.(s): AD-A435759; AFRL-SR-AR-TR-05-0297; No Copyright; Avail: CASI; [A02](#), Hardcopy

The workshop was held in August following the contractors meeting to discuss the UAV testbeds that are currently being developed by several academic groups working with AFOSR, and AFRL. The main purpose of the workshop was to bring the primary researchers together with the goals of: (1) Developing a consistent and flexible simulation environment for the cooperative control problem. The primary roles of this simulation would be to facilitate communication between researchers (both academic and government) using a common platform with consistent assumptions. The scenarios and setup would be designed to focus on the role of uncertainty in the distributed control problem (either due to inconsistent or incomplete information) and (2) Establishing what UAV platforms are currently available. What demonstrations have been done, and what do we expect to show in the next 3 years?

DTIC

Aircraft; Simulation; Test Stands

20050201057 Defense Acquisition Univ., Fort Belvoir, VA USA

Tactical Aircraft Modernization: Issues for Congress

Bolkcom, Christopher; Mar. 2004; 19 pp.; In English

Report No.(s): AD-A435817; IB92115; No Copyright; Avail: Defense Technical Information Center (DTIC)

This Issue Brief examines the Department of Defense's (DoD) four largest tactical aircraft modernization programs. The background section provides a brief description of each program, and a discussion of how tactical aircraft fit into military air operations (i.e., the missions they typically perform, and how they contrast to long-range combat aircraft). The Analysis section examines a number of policy issues, including affordability, capability required, force structure, service roles and missions, industrial base, and transformation. The paper concludes with a synopsis of recent congressional action on these

programs. The Defense Department plans to buy the F/A-22 fighter for the Air Force, the F/A-18E/F fighter/attack plane for the Navy, and the V-22 tilt-rotor aircraft for the Marines, as well as pursue a joint service program to develop a multi-role Joint Strike Fighter (JSF) aircraft in three variants, some of which might be operational around 2010. Decisions in Congress and DoD regarding these aircraft programs may have important long-term implications. The F/A-18E/F is entering production. The V-22 and the F/A-22 are now in transition from research and development to procurement and could remain in production for decades. The next-generation combat aircraft that are expected to result from joint service efforts now getting underway through the JSF program might be in production through the 2020s. Decisions about the funding of these programs will influence which U.S. aircraft manufacturers survive in the aviation industry, and may well affect the division of combat roles and missions among the services in the next century. Because of the lack of consensus about future threats and defense requirements, there has been increasing skepticism about the need for some of these aircraft programs on the grounds of cost and affordability, military requirements and force levels, and effects on the defense industrial base.

DTIC

Fighter Aircraft; Industries; Jet Aircraft; Procurement; Tilt Rotor Aircraft

20050201069 Georgia Inst. of Tech., Atlanta, GA USA

Development of Stress Gradient Enhanced Piezoelectric Actuator Composites

Lynch, Christopher S.; Nov. 2004; 37 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0030

Report No.(s): AD-A435846; AFRL-SR-AR-TR-05-0294; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report describes a multifunctional skin material that integrates piezoelectric layers to achieve multiple functions. These materials act as structural elements, have embedded piezoelectric actuation for shape control and active vibration suppression, and have in integral NDE system that utilizes a portion of the piezoelectric element for the detection of delaminations and cracks. Classical lamination theory modified to include piezoelectric layers was used as a design tool for the development of the skin material. The design utilized differential thermal expansion during processing to induce a residual compressive stress in the piezoelectric layer of the active skins resulting in high reliability and good resistance to fatigue.

DTIC

Actuators; Composite Materials; Delaminating; Detection; Laminates; Piezoelectricity; Stress Distribution

20050201087 Naval Postgraduate School, Monterey, CA USA

Implementation and Analysis of the Chromakey Augmented Virtual Environment (ChrAVE) Version 3.0 and Virtual Environment Helicopter (VEHELO) Version 2.0 in Simulated Helicopter Training

Hahn, M. E.; Jun. 2005; 143 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435874; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Chromakey Augmented Virtual Environment (ChrAVE) 3.0 System is a training system created to augment initial, refresher, and proficiency training in helicopter aviation using accurate simulation. Designed around advanced chromakey technologies, this system is deployable, scalable, and flexible, allowing for use in austere environments such as aboard ship or in forward deployed locations. The goal of system development was to prove that a collection of commercially available components could be integrated along with the Virtual Environment Helicopter (VEHELO) 2.0 software package in order to provide a realistic simulated environment in which pilots can practice skill sets that are critical to mission success. The focus of this thesis is the validation of ChrAVE 3.0 as an augmented trainer that can be adapted for use inside an actual aircraft cockpit. By placing the pilot in the most realistic simulation available ChrAVE 3.0 will enhance development of skills such as Terrain Appreciation, Crew Resource Management (CRM), and Situational Awareness (SA). Continuing past research, this thesis will analyze empirical data collected from training flights to further prove its value as an instructional tool. ChrAVE 3.0 is housed in three man-portable containers and can be set up within minutes with little or no prior experience.

DTIC

Education; Flight Training; Helicopters; Simulation

20050201088 Naval Postgraduate School, Monterey, CA USA

A Kernel Approach to the Estimation of Performance Measures in a Helicopter Ambulance Service with Missing Data

Gunes, Ersan; Jun. 2005; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435875; No Copyright; Avail: Defense Technical Information Center (DTIC)

We study two different operational scenarios for a regional air ambulance service-company which has bases in Northern California. Two of these bases serve the land areas encompassed roughly in a circular area of radius 100 miles centered in

Gilroy and Salinas, respectively; with a large part of their coverage areas reachable from either base. The base in Salinas currently operates one helicopter only from Thursday to Monday, whereas the base in Gilroy operates one helicopter 24/7. The company is considering extending the operation of one helicopter to 24/7 for its Salinas base. In this study we analyze the operational impacts of that extension, and develop a framework that can be applied towards the study of the ambulance assignment problem faced by small operators.

DTIC

Ambulances; Helicopters; Kernel Functions; Medical Services

20050201111 Wyle Labs., Inc., San Antonio, TX USA

Modification and Test of the CSU-13 B/P G-Suit for Use in the F/A-22

Balldin, Ulf; O'Connor, Robert; Isdahl, Wayne; Werchan, Paul; Jun. 2005; 28 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A435959; AFRL-HE-BR-TR-2005-0046; No Copyright; Avail: CASI; [A03](#), Hardcopy

In order to use the CSU 13 B/P G-suit in the F/A-22, modification of the suit or its aircraft mounted hoses are required. Necessary modifications were produced by the AFRL/HEP division. In unmanned tests the modified CSU-13 B/P G-suit passed all the tests regarding leakage, endurance, proof., burst leakage, and fill rate up to +9 G. Six human subjects were tested in the centrifuge with the CSU 13 B/P G-suit with hose inlet on the right or left side, and with COMBAT EDGE and Advanced Technology G Suit (CE-ATAGS). The tests did reveal any differences in the subjects tolerated G-levels during gradual onset runs with the two 13 B/P G-suits, but CE-ATAGS revealed a statistically significant lowered discomfort level and heart rate. During rapid onset runs G-duration was longer and heart rate was lower with CE-ATAGS. During simulated combat maneuver G-exposures the subjective effort level was lower with CE-ATAGS. Other comparisons did not show any statistically significant differences. In conclusion, no significant differences were shown between the use of CSU 13 B/P G-suit with the hose inlet on left or right side. However, CE-ATAGS showed some benefit over the CSU-13 B/P equipment conditions.

DTIC

Fighter Aircraft; Jet Aircraft; Pressure Suits

20050201115 QuesTek Innovations, LLC, Evanston, IL USA

Corrosion Resistant Steels for Structural Applications in Aircraft

Olson, Gregory; Feb. 2005; 211 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA72-01-C-0030; Proj-PP-1224

Report No.(s): AD-A435967; No Copyright; Avail: Defense Technical Information Center (DTIC)

Unlike chrome plating, where environmental and health problems are generally associated with the plating process, the problems with cadmium are intrinsic to the metal itself, creating occupational safety and health (OSH) risks and raising maintenance costs throughout the life of all cadmium plated parts. The only long-term answer to the problem is not a coating but a new steel that not only obviates the need for a coating but also eliminates these failures. This steel will be used not only in new landing gear designs, but also for sustainment of legacy systems, which is the reason that the Aging Landing Gear Life Extension program (ALGLE) is assisting in funding the development.

DTIC

Coatings; Corrosion Resistance; Landing Gear; Steels; Structural Design

20050201122 Civil Engineer Squadron (778th), Robins AFB, GA USA

Cost-Effective Ventilation of a Large-Aircraft Painting Facility at Robins AFB, Georgia

Wander, Joseph D.; Deaver, William H., III; Thovson, Jerry K.; Hurley, Toni; Doddington, Gerald; Apr. 2005; 51 pp.; In English

Contract(s)/Grant(s): Proj-2103

Report No.(s): AD-A435985; AFRL-ML-TY-TR-2004-4518; No Copyright; Avail: Defense Technical Information Center (DTIC)

Spray painting of large aircraft requires moving enormous quantities of air in an ordered manner to 1) clear overspray particles from the coated surface; 2) dilute the paint solvent vapors below their Lower Explosive Limit (LEL); and 3) keep concentrations of air toxic vapors and particles in the vicinity of the painting crew below the Occupational Exposure Limit (OEL). Standards promulgated in 29 CFR 1910.94 and 1910.107 prohibiting the use of partial exhaust recirculation were based on consensus standards that have since been revised to accommodate technology advances. Whereas the language of 29 CFR has not been revised, a body of interpretations has accumulated that provides a clear picture that a facility using

technology that provides 'equal or better protection' to its personnel enjoys immunity from citation under these standards. This paper describes the steps followed by a team of Robins AFB personnel to establish that an 80% recirculating design moving air at 60 ft/min will comply with 29 CFR 1910.1000 and National Fire Protection Association document 33, and to develop a set of design specifications for the construction of a climate-controlled hangar to paint C-5 aircraft at a cost saving of ^\$1M per plane compared to a conventionally designed (fresh air, 120 ft/min airflow) hangar.

DTIC

Circulation; Cost Effectiveness; Paints; Transport Aircraft; Ventilation

20050201613 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA

100TH T-38C Delivery Ceremony (Defense Acquisition Review Journal)

Ott, David D.; Davis, James B.; Oct. 2002; 13 pp.; In English

Report No.(s): AD-A435320; No Copyright; Avail: CASI; [A03](#), Hardcopy

In 2000, the USA Air Force T-38 Avionics Upgrade System Program Office began to pursue Lean initiatives to reduce out-year program cost and delivery risk at the Boeing T-38C Upgrade facility located at Williams Gateway Airport facility in Mesa, Arizona. The T-38 Avionics Upgrade Program production system baseline plan was conventional for legacy aircraft upgrade and modification programs using a mass/craft assembly stationary dock approach. For a successful transition from conventional to Lean production, program management support is critical. The T-38 Program Office in St. Louis, Missouri proposed a four-phase approach to implementation. This approach and the benefits derived from the process are discussed.

DTIC

Aircraft; Production Planning; Project Planning

20050201617 Defense Acquisition Univ., Fort Belvoir, VA USA

F/A-22 Raptor

Bolkcom, Christopher; Apr. 2004; 26 pp.; In English

Report No.(s): AD-A435449; No Copyright; Avail: Defense Technical Information Center (DTIC)

The F/A-22 Raptor is a next-generation fighter/attack aircraft that features the latest stealth technology to reduce detection by radar. Using more advanced engines and avionics than the Current F-15 Eagle, the F/A-22 is intended to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. This report examines the Air Force's F/A-22 Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity the program. In 1986 two contractors were selected to build competing prototypes, Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development, now termed 'Engineering & Manufacturing Development' (EMD). The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. If produced as now projected, F/A-22s could begin replacing F-15s after 2005. Through FY2004, Congress provided some \$41 billion for the F/A-22 A 279-aircraft program was estimated by DOD in December 2003 to cost about \$72 billion in actual prior-year and projected out-year expenditures. The Administration's FY2005 budget requested \$4.5 billion for the F/A-22 program in procurement and development funds. The F/A-22 has had strong Congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999.

DTIC

Fighter Aircraft; Aircraft Engines; F-15 Aircraft; Stealth Technology

20050201626 Naval Postgraduate School, Monterey, CA USA

Friction Stir Processing of Nickel-Aluminum Propeller Bronze in Comparison to Fusion Welds

Murray, David L.; Jun. 2005; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435463; No Copyright; Avail: Defense Technical Information Center (DTIC)

Friction Stir Processing (FSP) is currently being considered for use in manufacture of the Navy's NiAl bronze propellers. Incorporating this technology may improve service performance and enable reduction of manufacturing time and cost. This program of research has employed miniature tensile sample designs to examine the distributions of longitudinal properties through the various regimes in a fusion weld. Also, the distributions of both longitudinal and transverse properties throughout the stir zones for selected FSP conditions were examined. Yield strengths were larger in various FSP conditions by at least a factor of two relative to fusion welds. Ultimate strengths were comparable in the weld pool and stir nugget. Widmanstätten

microstructures and microvoid formation and coalescence in the fracture surface resulted in high ductilities in weld metal and the stir nugget. The thermomechanically affected zone of FSP and the heat affected zone of a fusion weld both exhibit low ductility. This may reflect formation of beta upon heating to temperatures of 800-850 degrees C, followed by rapid cooling and transformation of the beta to form martensitic transformation products in their respective microstructures. For a single-pass raster pattern, transverse ductility is lower than longitudinal ductility. For a multi-pass raster, transverse ductility is higher than longitudinal ductility. For multi-pass raster and spiral patterns in FSP, the data show that the mechanical properties are more nearly isotropic.

DTIC

Aluminum Alloys; Bronzes; Friction Stir Welding; Friction Welding; Fusion Welding; Nickel Alloys; Nickel Aluminides; Propellers; Welded Joints

20050201656 Defense Acquisition Univ., Fort Belvoir, VA USA

F-35 Joint Strike Fighter (JSF) Program: Background, Status, and Issues

Bolkcom, Christopher; Apr. 2004; 30 pp.; In English

Report No.(s): AD-A435621; CRS-RL30563; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Defense Department's F-35 Joint Strike Fighter (JSF) is one of three aircraft programs at the center of current debate over tactical aviation, the others being the Air Force F/A-22 fighter and the Navy F/A-18E/F fighter/attack plane. In November 1996, the Defense Department selected two major aerospace companies, Boeing and Lockheed Martin, to demonstrate competing designs for the JSF, a joint- service and multi-role fighter/attack plane. On October 26, 2001, the Lockheed Martin team was selected to develop further and to produce a family of conventional take-off and landing (CTOL), carrier-capable (CV), and short take-off vertical landing (STOVL) aircraft for the U.S. Air Force, Navy, and Marine Corps and the U.K. Royal Navy as well as other allied services. Originally designated the Joint Advanced Strike Technology (JAST) program, the JSF program is a major issue in - Congress because of concerns about its cost and budgetary impact, effects on the defense industrial base, and implications for U.S. national security in the early 21st century.

DTIC

Fighter Aircraft; Defense Program

20050201657 Defense Acquisition Univ., Fort Belvoir, VA USA

Army Transformation and Modernization: Overview and Issues for Congress

Bruner, Edward F.; Mar. 2004; 7 pp.; In English

Report No.(s): AD-A435673; No Copyright; Avail: Defense Technical Information Center (DTIC)

Modernization is not a new issue or objective for U.S. military forces but it has taken on new urgency because of: the post-Cold War downsizing and procurement reductions, the new global environment and unexpected requirements, and the promise of a 'revolution in military affairs' (RMA) suggested by rapid developments in computers, communications, and guidance systems. The last notable surge in modernization culminated during the 'Reagan build-up' of the 1980's. Weapons and doctrines developed and fielded in that era made fundamental contributions to USA successes in the Cold War, the Gulf War, and Kosovo. For the Army, such weapons included the M1 Abrams tank, M2 Bradley armored fighting vehicle, Apache attack helicopter, Blackhawk utility helicopter, and Patriot air defense system.

DTIC

International Relations; Military Vehicles; Guidance (Motion)

20050201673 Merrell Publishers Ltd., London, UK

Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight

Springer, Anthony M.; August 2003; 192 pp.; In English; See also 20050201674 - 20050201680; Copyright; Avail: Other Sources

This volume presents the airplanes, boosters, and space vehicles produced by NASA and its predecessor organization, the National Advisory Committee on Aeronautics (NACA) and celebrates the unrivaled passion for excellence and creativity in design. The topics include: 1) Why do airplanes look the way they do? 2) The airplane and the streamline idiom in the USA; 3) Design for performance: The role of aesthetics in the development of aerospace vehicles; 4) Beauty in the beast: form and function in the early development of wind tunnels; 5) An indispensable ingredient: flight research and aircraft design; 6) Design for eons: of space and beyond; and 7) The future of flight

CASI

Aerospace Engineering; Space Flight; Aircraft Design

20050201674 Smithsonian Institution, Washington, DC, USA

The Airplane and the Streamline Idiom in the USA

Pisano, Dominick A.; *Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight*; August 2003, pp. 39-51; In English; See also 20050201673; Copyright; Avail: Other Sources

As a means of travel, commerce, and warfare, the airplane has brought about significant changes to the lives of people throughout the world. Indeed, its importance is so great that it can be said to have changed the course of civilization. Less obvious, however, and greatly overshadowed by its commercial and war-making potential, is the airplane's effect on American aesthetic and cultural values in the period beginning immediately before World War I and ending in the late 1930s.

Derived from text

Commerce; Military Operations; Aircraft Design

20050201675 Smithsonian Institution, Washington, DC, USA

Design for Performance: The Role of Aesthetics in the Development of Aerospace Vehicles

Anderson, John, Jr.; *Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight*; August 2003, pp. 53-79; In English; See also 20050201673; Copyright; Avail: Other Sources

Airplanes of all sizes and shapes fly overhead. When we pause to observe them, we see that many are aesthetically beautiful; a Boeing 777 jetliner, with its long, slender fuselage and gracefully swept wings, is a sight pleasing to the eye. The reason this author is an aeronautical engineer is the intense joy he experienced in building scale-model airplanes as a teenager, motivated by their aesthetic beauty. But did designers intentionally shape these airplanes to look beautiful, or was it simply a matter of form following function? This essay explores the role of aesthetics in aerospace vehicle design, especially in cases where the designers have pushed the limits of the technology. The American Heritage Dictionary of the English Language defines aesthetics as 'The branch of philosophy that provides a theory of the beautiful and of the fine arts.' The term was first introduced in the eighteenth century by the philosopher Alexander Baumgarten in his discussions on the science of perceptible beauty. The art world deals with this term with some uncertainty.

Derived from text

Aerospace Vehicles; Aircraft Models; Swept Wings

20050201676 Smithsonian Institution, Washington, DC, USA

Why Do Airplanes Look the Way They Do?

Crouch, Tom D.; *Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight*; August 2003, pp. 29-37; In English; See also 20050201673; Copyright; Avail: Other Sources

Why do airplanes look the way they do? The answer to that question begins with the realization that weight is the great enemy of flight. A flying machine is the only craft that has to lift into the air its own weight and that of a crew and useful payload before it can even begin to do its job. The most basic goal of the aeronautical engineer is to provide a flying machine that will meet its performance requirements and offer adequate strength and safety with minimum weight. As a consequence of that unforgiving problem, a successful aircraft design will reflect the underlying technology. Cayley's first glider had a simple fixed wing, control surfaces, and a means of tying these essential elements together. Anything else would have been excess weight. The means of achieving flight have evolved over time. Improved methods of propulsion, breakthroughs in aerodynamics, the advent of new materials, and a host of other factors that enabled us to fly higher, faster, farther, and more efficiently have reshaped our vision of the ideal airplane at critical moments during the century-long history of aviation.

Derived from text

Aerodynamics; Control Surfaces; Propulsion; Safety

20050201678 NASA Dryden Flight Research Center, Edwards, CA, USA

An Indispensable Ingredient: Flight Research and Aircraft Design

Gorn, Michael H.; *Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight*; August 2003, pp. 106-129; In English; See also 20050201673; Copyright; Avail: Other Sources

Flight research-the art of flying actual vehicles in the atmosphere in order to collect data about their behavior-has played a historic and decisive role in the design of aircraft. Naturally, wind tunnel experiments, computational fluid dynamics, and mathematical analyses all informed the judgments of the individuals who conceived of new aircraft. But flight research has offered moments of realization found in no other method. Engineer Dale Reed and research pilot Milt Thompson experienced one such epiphany on March 1, 1963, at the National Aeronautics and Space Administration's Dryden Flight Research Center in Edwards, California. On that date, Thompson sat in the cockpit of a small, simple, gumbdrop-shaped aircraft known as the

M2-F1, lashed by a long towline to a late-model Pontiac Catalina. As the Pontiac raced across Rogers Dry Lake, it eventually gained enough speed to make the M2-F1 airborne. Thompson braced himself for the world's first flight in a vehicle of its kind, called a lifting body because of its high lift-to-drag ratio. Reed later recounted what he saw:

Derived from text

Aircraft Design; Computational Fluid Dynamics; Lift Drag Ratio; Lifting Bodies

20050201944 Southwest Research Inst., San Antonio, TX USA

Polymer Flammability

Lyon, R. E.; Janssens, M. L.; May 2005; 86 pp.; In English

Report No.(s): PB2005-108934; No Copyright; Avail: CASI; [A05](#), Hardcopy

This report provides an overview of polymer flammability from a materials science perspective and describes currently accepted test methods to quantify burning behavior. Simplifying assumptions about the gas and condensed phase processes of flaming combustion provide mathematical relationships between polymer properties, chemical structure, flame resistance, and fire behavior that can be used to design fire-resistant plastics.

NTIS

Compartment; Fires; Flammability; Heat Transfer; Plastics

20050202081 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Vibration Analysis Tools and New Strategies for Robust Design of Turbine Engine Rotors

Min, James B.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The adverse effects of small, random structural irregularities among the blades, called mistuning, can result in blade forced-response amplitudes and stresses that are much larger than those predicted for a perfectly tuned rotor. Manufacturing tolerances, deviations in material properties, or nonuniform operational wear causes mistuning; therefore, mistuning is unavoidable. Furthermore, even a small mistuning can have a dramatic effect on the vibratory behavior of a rotor because it can lead to spatial localization of the vibration energy (see the following photographs). As a result, certain blades may experience forced response amplitudes and stresses that are substantially larger than those predicted by an analysis of the nominal (tuned) design. Unfortunately, these random uncertainties in blade properties, and the immense computational effort involved in obtaining statistically reliable design data, combine to make this aspect of rotor design cumbersome.

Derived from text

Dynamic Structural Analysis; Rotors; Turbine Engines; Vibration Measurement

20050202086 NASA Glenn Research Center, Cleveland, OH, USA

Gear Damage Detection Integrating Oil Debris and Vibration Measurement Technologies Developed

Gyekeyeski, Andrew L.; Sawicki, Jerzy T.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The development of highly reliable health-monitoring systems is one technology area recommended for reducing the number of helicopter accidents. Helicopter transmission diagnostics are an important part of a helicopter health-monitoring system because helicopters depend on the power train for propulsion, lift, and flight maneuvering. One technique currently being tested for increasing the reliability and decreasing the false alarm rate of current transmission diagnostic tools is the replacement of simple single-sensor limits with multisensor systems integrating different measurement technologies.

Derived from text

Damage; Debris; Detection; Diagnosis; Transmissions (Machine Elements); Vibration Measurement

20050203672 NASA Langley Research Center, Hampton, VA, USA

Experimental Results from the Active Aeroelastic Wing Wind Tunnel Test Program

Heeg, Jennifer; Spain, Charles V.; Florance, James R.; Wieseman, Carol D.; Ivanco, Thomas G.; DeMoss, Joshua; Silva, Walter A.; Panetta, Andrew; Lively, Peter; Tumwa, Vic; [2005]; 16 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-064-50-22

Report No.(s): AIAA Paper 2005-2234; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Active Aeroelastic Wing (AAW) program is a cooperative effort among NASA, the Air Force Research Laboratory and the Boeing Company, encompassing flight testing, wind tunnel testing and analyses. The objective of the AAW program is to investigate the improvements that can be realized by exploiting aeroelastic characteristics, rather than viewing them as

a detriment to vehicle performance and stability. To meet this objective, a wind tunnel model was crafted to duplicate the static aeroelastic behavior of the AAW flight vehicle. The model was tested in the NASA Langley Transonic Dynamics Tunnel in July and August 2004. The wind tunnel investigation served the program goal in three ways. First, the wind tunnel provided a benchmark for comparison with the flight vehicle and various levels of theoretical analyses. Second, it provided detailed insight highlighting the effects of individual parameters upon the aeroelastic response of the AAW vehicle. This parameter identification can then be used for future aeroelastic vehicle design guidance. Third, it provided data to validate scaling laws and their applicability with respect to statically scaled aeroelastic models.

Author

Aeroelastic Research Wings; Aeroelasticity; Wind Tunnel Tests; Transonic Wind Tunnels; Active Control

20050203870 Stavatti Military Aerospace, Saint Paul, MN USA

Air Weapon System Configuration Statement: SM-26S/T Machete

Jun. 2005; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435977; SD-65339-WS; No Copyright; Avail: Defense Technical Information Center (DTIC)

The SM-27 MACHETE is a fixed-wing military aircraft developed to satisfy Counter Insurgency (COIN), Close Air Support (CAS), Light Attack (LA), Forward Air Control (FAC) and Advanced Trainer (AT) missions. The SM-27 is a product of STAVATTI MILITARY AEROSPACE, a division of STAVATTI HEAVY INDUSTRIES, LTD. (STAVATTI). There is a distinct need for a capable replacement for OV-10 BRONCOs and A-37 DRAGONFLYs operated by U.S. allies worldwide. With over 230 such aircraft still in service today, STAVATTI identifies the SM-27 MACHETE as the only new platform which will effectively address this type of requirement. Furthermore, the USAF/AFRES/USANG has been operating 116 OA-10As in satisfaction of the FAC role. The average age of the OA-10A has exceeded 22 years and this type will require replacement within the next 10 to 20 years. The SM-27 is an appropriate successor to this type in the FAC/anti-terrorism role.

DTIC

Aircraft Configurations; Fighter Aircraft; Fixed Wings; Support Systems; Systems Engineering; Weapon Systems

20050203883 NASA Glenn Research Center, Cleveland, OH, USA

Life-Extending Control for Aircraft Engines Studied

Guo, Te-Huei; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Current aircraft engine controllers are designed and operated to provide both performance and stability margins. However, the standard method of operation results in significant wear and tear on the engine and negatively affects the on-wing life--the time between cycles when the engine must be physically removed from the aircraft for maintenance. The NASA Glenn Research Center and its industrial and academic partners have been working together toward a new control concept that will include engine life usage as part of the control function. The resulting controller will be able to significantly extend the engine's on-wing life with little or no impact on engine performance and operability. The new controller design will utilize damage models to estimate and mitigate the rate and overall accumulation of damage to critical engine parts. The control methods will also provide a means to assess tradeoffs between performance and structural durability on the basis of mission requirements and remaining engine life. Two life-extending control methodologies were studied to reduce the overall life-cycle cost of aircraft engines. The first methodology is to modify the baseline control logic to reduce the thermomechanical fatigue (TMF) damage of cooled stators during acceleration. To accomplish this, an innovative algorithm limits the low-speed rotor acceleration command when the engine has reached a threshold close to the requested thrust. This algorithm allows a significant reduction in TMF damage with only a very small increase in the rise time to reach the commanded rotor speed. The second methodology is to reduce stress rupture/creep damage to turbine blades and uncooled stators by incorporating an engine damage model into the flight mission. Overall operation cost is reduced by an optimization among the flight time, fuel consumption, and component damages. Recent efforts have focused on applying life-extending control technology to an existing commercial turbine engine, and doing so without modifying the hardware or adding sensors. This approach makes it possible to retrofit existing engines with life-extending control technology by changing only the control software in the full-authority digital engine controller (FADEC). The significant results include demonstrating a 20- to 30-percent reduction in TMF damage to the hot section by developing and implementing smart acceleration logic during takeoff. The tradeoff is an increase, from 5.0 to 5.2 sec, in the time required to reach maximum power from ground idle. On a typical flight profile of a cruise at Mach 0.8 at an altitude of 41,000 ft, and cruise time of 104 min, the optimized system showed that a reduction in cruise speed from Mach 0.8 to 0.79 can achieve an estimated 25-to 35-percent creep/rupture damage reduction in the engine's hot section and a fuel savings of 2.1 percent. The tradeoff is an increase in flight time of 1.3 percent (1.4 min).

Author

Aircraft Engines; Controllers; Life (Durability); Engine Control; Optimization

AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power*; *28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20050199466 NASA Glenn Research Center, Cleveland, OH, USA

Vibration Test Demonstrated Dynamic Capability of an Operating Stirling Converter

Hughes, William O.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center and the U.S. Department of Energy are currently developing a high-efficiency, long-life, free piston Stirling converter for use as an advanced spacecraft power system for future NASA missions. As part of this development, a Stirling Technology Demonstrator Converter (TDC), developed by Stirling Technology Company for the Department of Energy, was vibration tested at Glenn's Structural Dynamics Laboratory in November and December 1999. This testing demonstrated that the Stirling TDC is able to withstand the harsh random vibration (20 to 2000 Hz) seen during a typical spacecraft launch and to survive with no structural damage or functional power performance degradation, thereby enabling its use in future spacecraft power systems. Glenn and Stirling personnel conducted tests on a single 55 We TDC. The purpose was to characterize the TDC's structural response to vibration and to determine if the TDC could survive the vibration criteria established by the Jet Propulsion Laboratory for launch environments. The TDC was operated at full-stroke and full power conditions during the vibration testing.

Derived from text

Vibration Tests; Dynamic Structural Analysis; Dynamic Response; Stirling Cycle; Converters

20050199660 NASA Glenn Research Center, Cleveland, OH, USA

Case Studies of Fatigue Life Improvement Using Low Plasticity Burnishing in Gas Turbine Engine Applications

Prevey, Paul S.; Shepard, Michael; Ravindranath, Ravi A.; Gabb, Timothy; [2003]; 10 pp.; In English; ASME Turbo Expo 2003, 16-19 Jun. 2003, Atlanta, GA, USA; Copyright; Avail: CASI; [A02](#), Hardcopy

Surface enhancement technologies such as shot peening, laser shock peening (LSP), and low plasticity burnishing (LPB) can provide substantial fatigue life improvement. However, to be effective, the compressive residual stresses that increase fatigue strength must be retained in service. For successful integration into turbine design, the process must be affordable and compatible with the manufacturing environment. LPB provides thermally stable compression of comparable magnitude and even greater depth than other methods, and can be performed in conventional machine shop environments on CNC machine tools. LPB provides a means to extend the fatigue lives of both new and legacy aircraft engines and ground-based turbines. Improving fatigue performance by introducing deep stable layers of compressive residual stress avoids the generally cost prohibitive alternative of modifying either material or design. The X-ray diffraction based background studies of thermal and mechanical stability of surface enhancement techniques are briefly reviewed, demonstrating the importance of minimizing cold work. The LPB process, tooling, and control systems are described. An overview of current research programs conducted for engine OEMs and the military to apply LPB to a variety of engine and aging aircraft components are presented. Fatigue performance and residual stress data developed to date for several case studies are presented including: * The effect of LPB on the fatigue performance of the nickel based super alloy IN718, showing fatigue benefit of thermal stability at engine temperatures. * An order of magnitude improvement in damage tolerance of LPB processed Ti-6-4 fan blade leading edges. * Elimination of the fretting fatigue debit for Ti-6-4 with prior LPB. * Corrosion fatigue mitigation with LPB in Carpenter 450 steel. * Damage tolerance improvement in 17-4PH steel. Where appropriate, the performance of LPB is compared to conventional shot peening after exposure to engine operating temperatures.

Author

Gas Turbine Engines; Heat Resistant Alloys; Shot Peening; Plastic Properties

20050199661 NASA Glenn Research Center, Cleveland, OH, USA

Future Concepts for Modular, Intelligent Aerospace Power Systems

Button, Robert M.; Soeder, James F.; August 10, 2004; 8 pp.; In English; International Energy Conversion Engineering Conference, 15-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): 22-319-20-P1; No Copyright; Avail: CASI; [A02](#), Hardcopy

Nasa's resented commitment to Human and Robotic Space Exploration obviates the need for more affordable and sustainable systems and missions. Increased use of modularity and on-board intelligent technologies will enable these lofty

goals. To support this new paradigm, an advanced technology program to develop modular, intelligent power management and distribution (PMAD) system technologies is presented. The many benefits to developing and including modular functionality in electrical power components and systems are shown to include lower costs and lower mass for highly reliable systems. The details of several modular technologies being developed by NASA are presented, broken down into hierarchical levels. Modularity at the device level, including the use of power electronic building blocks, is shown to provide benefits in lowering the development time and costs of new power electronic components.

Author (revised)

Robotics; Modularity; Power Supplies; Thrust

20050203845 NASA Glenn Research Center, Cleveland, OH, USA

Development of Parametric Mass and Volume Models for an Aerospace SOFC/Gas Turbine Hybrid System

Tornabene, Robert; Wang, Xiao-yen; Steffen, Christopher J., Jr.; Freeh, Joshua E.; July 2005; 17 pp.; In English; Turbo Expo 2005, 6-9 Jun. 2005, Reno, NV, USA

Contract(s)/Grant(s): WBS 22-056-20-03

Report No.(s): NASA/TM-2005-213819; GT2005-68334; E-15177; No Copyright; Avail: CASI; [A03](#), Hardcopy

In aerospace power systems, mass and volume are key considerations to produce a viable design. The utilization of fuel cells is being studied for a commercial aircraft electrical power unit. Based on preliminary analyses, a SOFC/gas turbine system may be a potential solution. This paper describes the parametric mass and volume models that are used to assess an aerospace hybrid system design. The design tool utilizes input from the thermodynamic system model and produces component sizing, performance, and mass estimates. The software is designed such that the thermodynamic model is linked to the mass and volume model to provide immediate feedback during the design process. It allows for automating an optimization process that accounts for mass and volume in its figure of merit. Each component in the system is modeled with a combination of theoretical and empirical approaches. A description of the assumptions and design analyses is presented.

Author

Solid Oxide Fuel Cells; Gas Turbine Engines; Mathematical Models; Aerospace Systems

20050203852 NASA Glenn Research Center, Cleveland, OH, USA

System-Level Design of a Shape Memory Alloy Actuator for Active Clearance Control in the High-Pressure Turbine

DeCastro, Jonathan A.; Melcher, Kevin J.; Noebe, Ronald D.; July 2005; 21 pp.; In English; 41st Joint Propulsion Conference and Exhibit, 10-13 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): WBS 22-714-70-42

Report No.(s): NASA/TM-2005-213834; E-15204; AIAA Paper 2005-3988; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper describes results of a numerical analysis evaluating the feasibility of high-temperature shape memory alloys (HTSMA) for active clearance control actuation in the high-pressure turbine section of a modern turbofan engine. The prototype actuator concept considered here consists of parallel HTSMA wires attached to the shroud that is located on the exterior of the turbine case. A transient model of an HTSMA actuator was used to evaluate active clearance control at various operating points in a test bed aircraft engine simulation. For the engine under consideration, each actuator must be designed to counteract loads from 380 to 2000 lbf and displace at least 0.033 inches. Design results show that an actuator comprised of 10 wires 2 inches in length is adequate for control at critical engine operating points and still exhibits acceptable failsafe operability and cycle life. A proportional-integral-derivative (PID) controller with integrator windup protection was implemented to control clearance amidst engine transients during a normal mission. Simulation results show that the control system exhibits minimal variability in clearance control performance across the operating envelope. The final actuator design is sufficiently small to fit within the limited space outside the high-pressure turbine case and is shown to consume only small amounts of bleed air to adequately regulate temperature.

Author

Active Control; Actuators; High Pressure; Shape Memory Alloys; Turbofan Engines; Systems Engineering; Numerical Analysis

20050203879 NASA Glenn Research Center, Cleveland, OH, USA

Turbopump Performance Improved by Evolutionary Algorithms

Oyama, Akira; Liou, Meng-Sing; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The development of design optimization technology for turbomachinery has been initiated using the multiobjective

evolutionary algorithm under NASA's Intelligent Synthesis Environment and Revolutionary Aeropropulsion Concepts programs. As an alternative to the traditional gradient-based methods, evolutionary algorithms (EA's) are emergent design-optimization algorithms modeled after the mechanisms found in natural evolution. EA's search from multiple points, instead of moving from a single point. In addition, they require no derivatives or gradients of the objective function, leading to robustness and simplicity in coupling any evaluation codes. Parallel efficiency also becomes very high by using a simple master-slave concept for function evaluations, since such evaluations often consume the most CPU time, such as computational fluid dynamics. Application of EA's to multiobjective design problems is also straightforward because EA's maintain a population of design candidates in parallel. Because of these advantages, EA's are a unique and attractive approach to real-world design optimization problems.

Derived from text

Turbine Pumps; Performance Prediction; Algorithms; Design Analysis

20050203890 NASA Glenn Research Center, Cleveland, OH, USA

Progress in High Power Density SOFC Material Development for Aerospace Applications

Cable, Thomas L.; Sofie, Stephen W.; Setlock, John A.; Misra, Ajay K.; [2004]; 1 pp.; In English; 2004 Fuel Cell Seminar, 1-5 Nov. 2004, San Antonio, TX, USA

Contract(s)/Grant(s): WBS 22-708-31-01; Copyright; Avail: CASI; [A01](#), Hardcopy

Solid oxide fuel cell (SOFC) systems for aircraft applications require order of magnitude increase in specific power density and long life under aircraft operating conditions. Advanced SOFC materials and fabrication processes are being developed at NASA GRC to increase specific power density and durability of SOFC cell and stack. Initial research efforts for increasing specific power density are directed toward increasing the operating temperature for the SOFC system and reducing the weight of the stack. While significant research is underway to develop anode supported SOFC system operating at temperatures in the range of 650 - 850 C for ground power generation applications, such temperatures may not yield the power densities required for aircraft applications. For electrode-supported cells, SOFC stacks with power densities greater than 1.0 W/sq cm are favorable at temperatures in excess of 900 C. The performance of various commercial and developmental anode supported cells is currently being evaluated in the temperature range of 900 to 1000 C to assess the performance gains and materials reliability. The results from these studies will be presented. Since metal interconnects developed for lower temperature operation are not practical at these high temperatures, advanced perovskite based ceramic interconnects with high electronic conductivity and lower sintering temperatures are being developed. Another option for increasing specific power density of SOFC stacks is to decrease the stack weight. Since the interconnect contributes to a significant portion of the stack weight, considerable weight benefits can be derived by decreasing its thickness. Eliminating the gas channels in the interconnect by engineering the pore structure in both anode and cathode can offer significant reduction in thickness of the ceramic interconnect material. New solid oxide fuel cells are being developed with porous engineered electrode supported structures with a 10 - 20 micron thin electrolyte. The performance data for advanced SOFC cells with engineered porosity in both electrodes will be presented.

Author (revised)

Solid Oxide Fuel Cells; Aircraft Power Supplies; Stacks; Electrode Materials; Porosity

20050203899 Tokyo Metropolitan Univ., Tokyo, Japan

New Space Technology: 1km Tether to 100,000km Space Elevator

Fujii, Hironori A.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Tether technology is a very old technology used for human activity in fabric works for clothes, fishing and hunting, building, and tethering horses and dogs. The tether technology is now becoming one of new and promising technologies for human space activities as spacecraft thrusters, power generators, and important elements of space infrastructures. The present paper addresses some recent works of the author on the space tether technology applied to an aurora experiment using a sounding rocket, a space solar power satellite and a space elevator for lifting us from the Earth to space.

Author

Tethering; Electric Generators; Aerospace Engineering; Technology Transfer

20050204000 QSS Group, Inc., USA, Department of the Army, USA

Hybrid Neural-Network: Genetic Algorithm Technique for Aircraft Engine Performance Diagnostics Developed and Demonstrated

Kobayashi, Takahisa; Simon, Donald L.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

As part of the NASA Aviation Safety Program, a unique model-based diagnostics method that employs neural networks and genetic algorithms for aircraft engine performance diagnostics has been developed and demonstrated at the NASA Glenn Research Center against a nonlinear gas turbine engine model. Neural networks are applied to estimate the internal health condition of the engine, and genetic algorithms are used for sensor fault detection, isolation, and quantification. This hybrid architecture combines the excellent nonlinear estimation capabilities of neural networks with the capability to rank the likelihood of various faults given a specific sensor suite signature. The method requires a significantly smaller data training set than a neural network approach alone does, and it performs the combined engine health monitoring objectives of performance diagnostics and sensor fault detection and isolation in the presence of nominal and degraded engine health conditions.

Author

Genetic Algorithms; Neural Nets; Gas Turbine Engines; Fault Detection; Diagnosis

08

AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20050201064 Nukove Scientific Consulting, LLC, Ranchos de Taos, NM USA

Adaptive Laser Beam Control Using Return Photon Statistics

Chandler, Susan M.; May 2005; 4 pp.; In English

Report No.(s): AD-A435838; AFRL-SR-AR-TR-05-0298; No Copyright; Avail: CASI; [A01](#), Hardcopy

This Status Report, satisfying CLIN 000 1AB for the referenced contract, highlights the progress the Nukove Team has made during the second quarter of the Year One effort (1 March 2005-30 May 2005). Susan Chandler has had discussions with Mew Mexico State University, and Gordon Lukesh has talked extensively with NMSU statistician Deva Borah. Susan Chandler has had numerous discussions with Woof Consulting, solving the thorny issue of data sharing.

DTIC

Adaptive Control; Laser Beams; Optical Properties; Photons

20050204001 NASA Langley Research Center, Hampton, VA, USA

Linear-Parameter-Varying Antiwindup Compensation for Enhanced Flight Control Performance

Lu, Bei; Wu, Fen; Kim, Sung Wan; [2005]; 14 pp.; In English

Contract(s)/Grant(s): NAG1-01119; No Copyright; Avail: CASI; [A03](#), Hardcopy

Actuator saturation is one of the major issues of flight control in the high angle-of-attack region. This paper presents a saturation control scheme for linear parameter varying (LPV) systems from an antiwindup control perspective. The proposed control approach is advantageous from the implementation standpoint because it can be thought of as an augmented control algorithm to the existing control system. Moreover, the synthesis condition for an antiwindup compensator is formulated as a linear matrix inequality (LMI) optimization problem and can be solved efficiently. We have applied the LPV antiwindup controller to an F-16 longitudinal autopilot control system design and compared it with the thrust vectoring control scheme. The nonlinear simulations show that an LPV antiwindup controller improves flight quality and offers advantages over thrust vectoring in a high angle-of-attack region.

Author

Control Systems Design; Flight Control; Linear Parameter-Varying Control; Optimization; Aircraft Performance

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20050199460 NASA Glenn Research Center, Cleveland, OH, USA

Multimillion Dollar Construction Project Completed in Glenn's Icing Research Tunnel

Kevdzija, Susan L.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Over the last year, the Glenn Research Center's Icing Research Tunnel (IRT) underwent a major \$5.2 million rehabilitation project as part of the Construction of Facilities program. The scope of the project included redesign and replacement of the 55-yr-old heat exchanger, the addition of fan outlet guide vanes for flow conditioning downstream of the 25-ft-diameter fan, and redesign and replacement of the C and D corner-turning vanes. The purpose of the rehabilitation was to replace old portions of the infrastructure and to improve the aerodynamic flow quality in the tunnel.

Derived from text

Test Facilities; Ice Formation; Wind Tunnels

20050199761 NASA Dryden Flight Research Center, Edwards, CA, USA

Rehabilitation of the Rocket Vehicle Integration Test Stand at Edwards Air Force Base

Jones, Daniel S.; Ray, Ronald J.; Phillips, Paul; August 15, 2005; 58 pp.; In English

Contract(s)/Grant(s): 710-55-24-SE-RR

Report No.(s): NASA/TM-2005-212863; H-2566; No Copyright; Avail: CASI; [A04](#), Hardcopy

Since initial use in 1958 for the X-15 rocket-powered research airplane, the Rocket Engine Test Facility has proven essential for testing and servicing rocket-powered vehicles at Edwards Air Force Base. For almost two decades, several successful flight-test programs utilized the capability of this facility. The Department of Defense has recently demonstrated a renewed interest in propulsion technology development with the establishment of the National Aerospace Initiative. More recently, the National Aeronautics and Space Administration is undergoing a transformation to realign the organization, focusing on the Vision for Space Exploration. These initiatives provide a clear indication that a very capable ground-test stand at Edwards Air Force Base will be beneficial to support the testing of future access-to-space vehicles. To meet the demand of full integration testing of rocket-powered vehicles, the NASA Dryden Flight Research Center, the Air Force Flight Test Center, and the Air Force Research Laboratory have combined their resources in an effort to restore and upgrade the original X-15 Rocket Engine Test Facility to become the new Rocket Vehicle Integration Test Stand. This report describes the history of the X-15 Rocket Engine Test Facility, discusses the current status of the facility, and summarizes recent efforts to rehabilitate the facility to support potential access-to-space flight-test programs. A summary of the capabilities of the facility is presented and other important issues are discussed.

Author

Engine Tests; Flight Tests; Ground Tests; X-15 Aircraft; Test Stands

20050201677 Auburn Univ., AL, USA

Beauty in the Beast: Form and Function in the Early Development of Wind Tunnels

Hansen, James R.; Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight; August 2003, pp. 74-105; In English; See also 20050201673; Copyright; Avail: Other Sources

If an average person were to eyeball any of the world's first wind tunnels, the initial impression would be much like Luke Skywalker's harsh snap judgment of the Millennium Falcon. All of these pioneering aerodynamic test machines looked pretty ugly. Certainly, nothing about their outer appearance gave away the fact that here was a machine that would prove absolutely fundamental to the future progress of aeronautics. British experimenter Francis H. Wenham built the world's first wind tunnel in 1871. Aesthetically, the device was not much to look at, simply a 10 foot (3 meter) long wooden horizontal box measuring 18 inches (45.7 cm) square. Through it, a flow of air was driven at speeds up to 40 miles (64 km) per hour by a small fan located at one end. To the untrained eye, any number of everyday appliances from the Victorian age, from cotton gins to washing machines, look more complicated and interesting than Wenham's duct. The world's next wind duct (the term 'wind tunnel' was not coined until the early 1900s), built by another Englishman, Horatio Phillips, in 1884, looked only slightly less boxy. Its more streamlined appearance was due primarily to the presence of a cone-shaped steam ejector. Made from sheet metal with double-curved surfaces, the ejector connected to one end of a 6 foot (1.8 meter) long box in order to draw air into,

through, and out of its test section. No one mistook Phillips's creation for a sculpture by Rodin, who happened to be unveiling a new masterpiece in 1884.

Derived from text

Aerodynamic Characteristics; Air Flow; Test Chambers; Wind Tunnels

20050201756 NASA Goddard Space Flight Center, USA

Gilmore Creek Geophysical Observatory

Caskey, Steve; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 51-53; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The following report provides a general technical description and operational overview of the Gilmore Creek Geophysical Observatory located near Fairbanks, Alaska.

Author

Geophysical Observatories; Satellite Communication

12

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20050200870 California Univ., Los Angeles, CA USA

Aerospace Technical Support for DARPA Network Modeling and Simulation Program and Cognitive Networks

Raghavendra, Cauligi; May 2005; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-2-0135; Proj-P771

Report No.(s): AD-A435465; AFRL-IF-RS-TR-2005-210; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this project was to provide technical support to the Defense Advanced Research Projects Agency's (DARPA) Network Modeling and Simulation (NMS) technical program. The effort acted as a facilitator for the NMS program by gathering information from program participants to build realistic network models. This effort studied traffic characterizations and mobility required to support future battlefield networking scenarios. Realistic mobility models for an urban battlefield scenario were developed. These models contained sensor nodes, ad hoc ground nodes, Unmanned Aerial Vehicles (UAV) and satellite nodes. This effort also evaluated the suitability for use in military networks, the traffic models and analysis techniques developed by other researchers in the NMS program.

DTIC

Aerospace Systems; Communication Networks; Mathematical Models; Network Analysis; Simulation

20050200877 Air Force Research Lab., Hanscom AFB, MA USA

Electrostatic Charging of Mirrors in Space: A Plausible Cause of Solar Panel Anomalies on Satellites

Lai, Shu T.; Jul. 2005; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-5021

Report No.(s): AD-A435475; AFRL-VS-HA-TR-2005-1076; No Copyright; Avail: Defense Technical Information Center (DTIC)

The entire fleet of Boeing Model 702 geosynchronous satellites has suffered from a similar fate: degradation of the solar cell panels. Mirrors flank both sides of the solar cell panels. Degradation sometimes sudden and stepwise, shortens the lifetime of the solar cells. We suggest that space environment effects play an important role in damaging the solar cells. As a cornerstone in this idea, we expound a theorem that high reflectivity reduces photoemission. With little or no photoemission, mirrors often charge to minus kilovolts in eclipse as well as in sunlight, whenever the space plasma is hot enough. Since the rest of the solar panel does not have this mirror property, differential charging between the mirrors and the rest of the solar panel occurs during eclipse exits. We show the charging data obtained during an eclipse exit on LANL-97A satellite for supporting the idea of differential charging. Finally, we recommend this important mirror charging property to be taken in

account in future solar panel designs and in commercial products of spacecraft charging computer codes.
DTIC

Aerospace Environments; Anomalies; Electrostatics; Mirrors; Panels; Solar Cells; Spacecraft Charging

20050200932 Naval Postgraduate School, Monterey, CA USA

The Art of Peace: Dissuading China from Developing Counter Space Weapons

Meteyer, David O.; Jun. 2005; 123 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435590; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis assesses the viability of applying dissuasion towards the development of offensive counter space (OCS) systems by China. As a relatively new defense policy and certainly one that has never been explicitly applied previously, this thesis delves into the characteristics prescribed by recent U. S. planning documents to develop a strategy that more appropriately addresses the current security concerns. Implicitly, dissuasion is intended to prevent future arms races with China through well-placed U.S. actions that channel adversary efforts in a direction desired by Washington. Several things become clear during this investigation. First, very little scholarly work exists discussing the concept of dissuasion and the mechanisms used to formulate, implement, and execute it as a defense policy. Second, that while an admirable attempt to lessen the need for more costly policy options such as deterrence and defeat, dissuasion will not prevent China from developing counter space weapons, especially since ground-based jammers that target satellite links have already proven effective. Third, the best chance of dissuading China's efforts to acquire space-based OCS systems is through international treaties and laws.

DTIC

Aerospace Systems; China; Policies; Security; Space Weapons; United States

20050200972 Naval Postgraduate School, Monterey, CA USA

Optimizing Bandwidth on Tactical Communications Systems

Cox, Criston W., Jr; Jun. 2005; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435663; No Copyright; Avail: Defense Technical Information Center (DTIC)

Current tactical networks are oversaturated, often slowing systems down to unusable speeds. Utilizing data collected from major exercises and Operation Iraqi Freedom II (OIF II), a typical model of existing tactical network performance is modeled and analyzed using NETWARS, a DISA sponsored communication systems modeling and simulation program. Optimization technologies are then introduced, such as network compression, caching, Quality of Service (QoS), and the Space Communication Protocol Standards Transport Protocol (SCPS-TP). The model is then altered to reflect an optimized system, and simulations are run for comparison. Data for the optimized model was obtained by testing commercial optimization products known as Protocol Enhancement Proxies (PEPs) at the Marine Support Activity (MCTSSA) testing laboratory.

DTIC

Bandwidth; Space Communication; Telecommunication

20050201033 Air Force Research Lab., Hanscom AFB, MA USA

Why Do Spacecraft Charge in Sunlight? Differential Charging and Surface Condition

Lai, Shu T.; Tautz, Maurice; Jan. 2005; 11 pp.; In English

Contract(s)/Grant(s): F19628-00-C-0089; Proj-5021

Report No.(s): AD-A435778; AFRL-VS-HA-TR-2005-1078; No Copyright; Avail: CASI; [A03](#), Hardcopy

Why do spacecraft charge in sunlight? The first reason concerns differential charging between the sunlit and dark sides. A monopole-dipole model describing the differential charging potential distribution yields interesting theoretical results. We compare the results with observations. The second reason concerns reflectance. Much attention has been paid in recent years to the effect of surface conditions on secondary emission, which plays an essential role in spacecraft charging. In comparison, little or no attention has been paid to the effect of surface condition on photoemission, which plays a dominating role in spacecraft sunlight charging. We present theoretical reasoning why highly reflective mirrors generate substantially reduced photoemission. We have calculated, by using the Langmuir orbit- limited current balance equation in 1 -D, 2-D, and 3-D, the different surface potentials of various surface materials under typical space plasma conditions, satellite surface reflectivity values, and sunlight incidence angles. We present numerical results confining that with substantially reduced photoemission, highly reflective surfaces would often charge to high negative potentials in sunlight.

DTIC

Artificial Satellites; Photoelectric Emission; Spacecraft Charging; Sunlight; Surface Properties

20050201063 Department of Defense, Washington, DC USA

Legal Aspects of Offensive Information Operations in Space

Wingfield, Thomas C.; Jan. 2005; 17 pp.; In English

Report No.(s): AD-A435835; No Copyright; Avail: Defense Technical Information Center (DTIC)

What, then, are the specific steps to follow in performing a legal analysis of offensive information operations in space? First, correctly identify the type and subtype of operation contemplated. The three types are intelligence collection, offensive operations through satellites, and offensive operations against satellites. The subtypes for each are listed in the second section of this paper. Second, determine if this type of operation, in the light of all relevant circumstances, rises to the level of a use of force. Although international legal academics are only now turning to this question, the one settled concept in this area is that an information operation crosses the Article 2(4) threshold when it produces effects comparable to those of a kinetic attack which would be thought of as having crossed the threshold. What more than that would constitute a use of force is still an open question. If the action is the equivalent of a use of force, it may only be undertaken pursuant to Chapter VII authorization, or as a lawful exercise of self-defense. Assuming the legality of acting at all, the operation must be conducted in accordance with the customary international legal standards of proportionality, discrimination, and chivalry. Offensive information operations in space will drive a revolution in technical, tactical, and legal thought. It is for the attorney adviser to the warfighter to present honest, closely reasoned legal advice to his client so that he may fight honorably and effectively.

DTIC

Aerospace Environments; Security

20050201653 Naval Postgraduate School, Monterey, CA USA

Multi-National Cooperation in Space Operations

Perry, David R.; Jun. 2005; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435561; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis discusses multi-national cooperation in space operations and its dependence on the human component. It includes a discussion of the history of U.S.-Russian cooperation, specifically the Apollo-Soyuz Test Project, the Shuttle-Mir Program and finally the origins of the International Space Station (ISS). This thesis goes into detail about the communication process between the International Space Station, the Mission Control Center Houston (MCC-H) and the Mission Control Center Moscow (MCC-M) with emphasis on the human component. This thesis further discusses the impact of personal relationships in the daily operation of the International Space Station. Finally, this thesis discusses lessons learned and additional applications where personal relationships can affect multi-national operations.

DTIC

Space Missions; International Space Station; Telecommunication

20050201937 Lawrence Livermore National Lab., Livermore, CA USA

Retrieval Using Texture Features in High Resolution Multi-Spectral Satellite Imagery

Newsam, S. D.; Kamath, C.; Jan. 27, 2004; 20 pp.; In English

Report No.(s): DE2005-15013919; UCRL-CONF-201981; No Copyright; Avail: Department of Energy Information Bridge

Texture features have long been used in remote sensing applications to represent and retrieve image regions similar to a query region. Various representations of texture have been proposed based on the Fourier power spectrum, spatial co-occurrence, wavelets, Gabor filters, etc. These representations vary in their computational complexity and their suitability for representing different region types. Much of the work done thus far has focused on panchromatic imagery at low to moderate spatial resolutions, such as images from Landsat 1-7 which have a resolution of 15-30 m/pixel, and from SPOT 1-5 which have a resolution of 2.5-20 m/pixel. However, it is not clear which texture representation works best for the new classes of high resolution panchromatic (60-100 cm/pixel) and multi-spectral (4 bands for red, green, blue, and near infra-red at 2.4-4 m/pixel) imagery. It is also not clear how the different spectral bands should be combined. In this paper, we investigate the retrieval performance of several different texture representations using multi-spectral satellite images from IKONOS. A query-by-example framework, along with a manually chosen ground truth dataset, allows different combinations of texture representations and spectral bands to be compared. We focus on the specific problem of retrieving inhabited regions from images of urban and rural scenes. Preliminary results show that (1) the use of all spectral bands improves the retrieval performance, and (2) co-occurrence, wavelet and Gabor texture features perform comparably.

NTIS

Analogies; High Resolution; Satellite Imagery; Textures

20050203738 NASA Langley Research Center, Hampton, VA, USA

Vacuum/Zero Net-Gravity Application for On-Orbit TPS Tile Repair

Harvey, Gale A.; Humes, Donald H.; Siochi, Emilie J.; 23rd Space Simulation Conference Proceedings; [2005]; 26 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Orbiter Columbia catastrophically failed during reentry February 1, 2003. All Space Shuttle flights were suspended, including logistics support for the International Space Station. NASA Langley Research Center's (LaRC) Structures and Materials Competency is performing characterizations of candidate materials for on-orbit repair of orbiter Thermal Protection System (TPS) tiles to support Return-to-Flight activities led by Johnson Space Center (JSC). At least ten materials properties or attributes (adhesion to damage site, thermal protection, char/ash strength, thermal expansion, blistering, flaming, mixing ease, application in vacuum and zero gravity, cure time, shelf or storage life, and short-term outgassing and foaming) of candidate materials are of interest for on-orbit repair. This paper reports application in vacuum and zero net-gravity (for viscous flow repair materials). A description of the test apparatus and preliminary results of several candidate materials are presented. The filling of damage cavities is different for some candidate repair materials in combined vacuum and zero net-gravity than in either vacuum or zero net-gravity alone.

Author

Space Shuttle Orbiters; Space Maintenance; Tiles; Spacecraft Shielding; Materials Tests; Weightlessness Simulation; Vacuum Tests

14

GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20050201729 Bundesamt fuer Kartographie und Geodaesie, Germany

German Antarctic Receiving Station (GARS) O'Higgins

Schlueter, Wolfgang; Ploetz, Christian; Schwarz, Walter; Wojdziak, Reiner; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 90-92; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

In 2004 the German Antarctic Receiving Station (GARS) in O'Higgins contributed to the IVS observing program with 10 observation sessions. Mark 5 system has been used. Remote Control Software and Hardware has been installed and successfully used.

Author

Radio Telescopes; Very Long Base Interferometry; Receivers; Ground Stations; Satellite Communication; Antarctic Regions

20050203713 NASA Goddard Space Flight Center, Greenbelt, MD, USA

23rd Space Simulation Conference Proceedings

[2005]; In English; 23rd Space Simulation Conference, 8-11 Nov. 2004, Annapolis, MD, USA; See also 20050203714 - 20050203744; Original contains color and black and white illustrations
Report No.(s): NASA/CP-2005-212775; No Copyright; Avail: CASI; [C01](#), CD-ROM

The proceedings of this conference address space environment simulation for full-scale ground tests of spacecraft, as well as testing of spacecraft components and instruments. Some of the testing and simulation techniques addressed in the conference papers include: thermal vacuum tests, cryogenic tests, thermal cycling tests, structural dynamics tests, vibration tests, magnetic tests, weightlessness simulation, solar simulation, and Mars environment simulation. The papers also address space environment test facilities, including their control systems.

CASI

Space Environment Simulation; Conferences; Environmental Tests; Dynamic Structural Analysis; Ground Tests; Environmental Laboratories; Test Facilities; Test Chambers

20050203714 General Dynamics C4 Systems, Gilbert, AZ, USA

Design And Construction of a Thermal Vacuum Test Facility for Spectrum Astro

Corral, Daniel; 23rd Space Simulation Conference Proceedings; [2005]; 54 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Construction of Spectrum Astro's 138,962 square foot Factory of the Future, housing its 17-foot diameter by 20-foot long thermal vacuum chamber, was completed on February 9th, 2004 in Gilbert, Arizona. The state-of-the-art thermal vacuum chamber has an internal working volume of 90 cubic meters and has an operating temperature range capability of -150C to +125C. The premier facility offers the spacecraft environmental testing industry the optimum in technologically advanced hardware, software, safety, utility, and reliability in environmental testing. The phase 0 initial build-out includes the installation and integration of a state of the art 17' diameter, 20' long horizontal thermal vacuum chamber, capable of testing system level flight hardware. The chamber is maintained to 10K clean room standards to accommodate most flight hardware requirements. Internal chamber contamination is measured with two Dycor Residual Gas Analyzers (RGAs) and two 15 MHz Quartz Crystal Microbalances (QCMs). Two types of Faraday QCM are used in the chamber, a Thermal electric Quartz Crystal Microbalance (TQCM) and a Cryogenic Quartz Crystal Microbalance. The pumping system consists of two Kinney mechanical roughing pumps and three 32' custom cryopumps capable of evacuating the chamber from atmosphere to the 5x10(exp -6) Torr regime within 6 hours. Temperature monitoring is performed using 600 thermocouple channels. All chamber data is fed into two National Instrument SCXI control modules and a National Instruments PXI control module for environment command, control, and data acquisition. Custom LabView software script is used to interface with the programmable logic controllers over the local area network (LAN). The custom software enables the chamber operator to perform every environmental test operation from a single computer screen. To test the new thermal vacuum system an acceptance test procedure (ATP) was created by the subcontractor and reviewed by Spectrum Astro to validate: time to 'pump down', chamber leak test performance, ramp rates, and chamber heating and cooling capabilities.

Author (revised)

Test Facilities; Thermal Vacuum Tests; Vacuum Chambers; Environmental Tests; Space Environment Simulation; Cryopumping

20050203715 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Swift Observatory Space Simulation Testing

Espiritu, Mellina; Choi, Michael K.; Scocik, Christopher S.; 23rd Space Simulation Conference Proceedings; [2005]; 27 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Swift Observatory is a Middle-Class Explorer (MIDEX) mission that is a rapidly re-pointing spacecraft with immediate data distribution capability to the astronomical community. Its primary objectives are to characterize and determine the origin of Gamma Ray Bursts (GRBs) and to use the collected data on GRB phenomena in order to probe the universe and gain insight into the physics of black hole formation and early universe. The main components of the spacecraft are the Burst Alert Telescope (BAT), Ultraviolet and Optical Telescope (UVOT), X-Ray Telescope (XRT), and Optical Bench (OB) instruments coupled with the Swift spacecraft (S/C) bus. The Swift Observatory will be tested at the Space Environment Simulation (SES) chamber at the Goddard Space Flight Center from May to June 2004 in order to characterize its thermal behavior in a vacuum environment. In order to simulate the independent thermal zones required by the BAT, XRT, UVOT, and OB instruments, the spacecraft is mounted on a chariot structure capable of maintaining adiabatic interfaces and enclosed in a modified, four section MSX fixture in order to accommodate the strategic placement of seven cryopanel (on four circuits), four heater panels, and a radiation source burst simulator mechanism. There are additionally 55 heater circuits on the spacecraft. To mitigate possible migration of silicone contaminants from BAT to the XRT and UVOT instruments, a contamination enclosure is to be fabricated around the BAT at the uppermost section of the MSX fixture. This paper discusses the test requirements and implemented thermal vacuum test configuration for the Swift Observatory.

Author

Astronomical Satellites; Test Facilities; Space Environment Simulation; Thermal Vacuum Tests

20050203718 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lessons Learned from the Hubble Space Telescope (HST) Contamination Control Program

Hansen, Patricia A.; Townsend, Jacqueline A.; Hedgeland, Randy J.; 23rd Space Simulation Conference Proceedings; [2005]; 55 pp.; In English; See also 20050203713; Original contains color and black and white illustrations; No Copyright; Avail: CASI; [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past two decades, the Hubble Space Telescope (HST) Contamination Control Program has evolved from a ground-based integration program to a space-based science-sustaining program. The contamination controls from the new-generation Scientific Instruments and Orbital Replacement Units were incorporated into the HST Contamination Control Program to maintain scientific capability over the life of the telescope. Long-term on-orbit scientific data has shown that these contamination controls implemented for the instruments, Servicing Mission activities (Orbiter, Astronauts, and mission), and

on-orbit operations successfully protected the HST from contamination and the instruments from self-contamination.

Author

Contamination; Hubble Space Telescope; Spacecraft Instruments; Orbital Assembly; Clean Rooms

20050203724 Canadian Space Agency, Ottawa, Ontario, Canada

Commissioning, Verification, and Validation of a Thermal Vibration Test Facility

Atkins, Gary; OGrady, Mark; Wiktowy, Michael; Singhal, Raj; 23rd Space Simulation Conference Proceedings; [2005]; 5 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An under utilized electrodynamic shaker has been modified to interface with a purpose built thermal chamber. This combined thermal-vibration environment test facility consists of a 6,000 lb force electro-dynamic shaker operating over a frequency bandwidth of 5 to 2,000 Hz while simultaneously thermally cycling over a temperature range of -50 to +150 C. The necessary equipment modifications, integration and verification for commissioning the new facility are outlined.

Author

Vibration Simulators; Test Facilities; Shakers; Thermal Cycling Tests

20050203728 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Force Measurement Device for ARIANE 5 Payloads

Brunner, Otto; Ratti, Francesco; 23rd Space Simulation Conference Proceedings; [2005]; 28 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ESTEC uses since 1991 a Force Measurement Device (FMD) for the measurement of dynamic mechanical forces and moments. This tool allows the determination of forces and moments applied to the test hardware at its interface to the test facilities during dynamic testing. Three forces and three moments are calculated from the measurements of eight tri-axial force links and used to either characterize the dynamic mechanical behaviour of the test item and/or to control forces and moments during vibration testing (force limited vibration control). The current FMD is limited to test items with an interface diameter of up to about 1.2 m (adapter available) and a mass compatible with ARIANE 4 payloads. The limitations of the current system come from the maximum of eight tri-axial force links and from the analogue technique of the Signal Processing Unit (SPU) that allows only a limited number of geometric configurations for the mechanical interface. Therefore ESA decided to develop a new FMD system. The system will include a digital real time SPU with 72 force input channels, corresponding to 24 tri-axes force sensors or 72 mono axial force sensors. The SPU design will allow extending the number of force input channels to 144. The set-up of the FMD will be done via a standard PC interface. The user will enter for each force sensor the location and the measurement direction in the reference coordinate system. Based on the geometrical information and the maximum forces and moments expected the PC will calculate the optimum range settings for the chargeamplifiers and the corresponding matrix with weighting factors which will allow to perform a fast calculation of the six output forces and moments from the 72 (or 144) input forces. The six output channels with forces and moments can then be connected either to the vibration control system or data acquisition system. The paper will present the status of the new FMD development and procurement. The selection criteria for sensor and signal conditioners and trade off results for several components will be shown. Finally the progress of the mechanical interface design will be reported.

Author

Ariane 5 Launch Vehicle; Measuring Instruments; Payloads; Dynamic Tests; Ground Tests

20050203729 General Dynamics C4 Systems, Gilbert, AZ, USA

State of the Art Multi-Functional Dynamics Test Facility

Yocum, Jason; Baker, Donald; 23rd Space Simulation Conference Proceedings; [2005]; 30 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Spectrum Astro Space Systems, a business area within General Dynamics C4 Systems, launched a multifunctional dynamics test facility that will pave the way for world-class spacecraft integrated environmental testing. Capabilities include: Acoustics, Vibration, Modal Survey, Static load, and Transient Capture (Shock, Separation, and Deployment). This state of the art environmental test facility is specifically designed to efficiently test a wide range of space flight hardware. How do you procure the title of state of the art? For starters a dynamics test facility is classified a 100K clean room. The Facility includes a 20-ton crane with approximately 57 feet of hook height allowing for large payloads including those of a Shuttle class size.

The acoustic capabilities include 153 dB Overall Sound Pressure Level (OASPL). Utilizing a 1/3 octave spectrum from 25 10,000 Hz, the Acoustic horn room includes a sound generation system consisting of four 100 Hz horns, one 50 Hz horn and one large 25 Hz horn. The horns are fed by gaseous nitrogen (GN2) and chilled water used for cooling the four 100 Hz acoustic modulators. Vibration capabilities also fall in the state of the art category. A 130,000 lb exciter-slip table combo base located inside the acoustic chamber with capabilities of 60,000 lbf rms Random, 65,000 lb(sub f pk) Sine, and 180,000 lbf shock allows both vibration and acoustics testing to be performed simultaneously. The acoustic chamber digital control system is equipped with automatic shutdown capability including over test protection, and adjacent areas low oxygen sensing. It also includes horn room, main chamber, and personnel door open sensing protection.

Author (revised)

Test Facilities; Dynamic Tests; Environmental Tests; Space Environment Simulation; Test Chambers

20050203731 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
New ESA EMC Test Facility Maxwell

Popovitch, A.; Suchail, J.-L.; 23rd Space Simulation Conference Proceedings; [2005]; 15 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents the new ESA-ESTEC large EMC facility, called Maxwell. The net dimensions between the absorber tips of this EMC chamber (14.5m x 10.7m x 11m) make it compatible with Ariane-5 single passenger launch configuration satellites, in line with the other Environmental Test Facilities already existing at ESA-ESTEC, complementing the mechanical vibration (HYDRA), acoustic (LEAF), thermal vacuum (LSS) and antenna/payload radio-frequency test facilities (CPTR). Access for the specimen to the EMC chamber is made possible through a large dimension door (6m wide x 11m high), using a non-conductive 5m x 5m air cushion pallet sliding on an anti-static epoxy coated floor. A specially designed air cooled high power dissipation wall provides the possibility of testing high power telecommunication satellites with a dissipation capability for RF spots up to densities of 3W/sq cm. High cleanliness absorbers lining the ceiling, the floor and the man doors have been installed as well as state of the art fire detection and suppression systems in order to ensure a safe testing of Flight Model satellites.

Author

Test Facilities; European Space Agency; Electromagnetic Compatibility; Buildings

20050203733 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Goddard Space Flight Center Spacecraft Magnetic Test Facility Restoration Project

Vernier, Robert; Bonalosky, Todd; Slavin, James; 23rd Space Simulation Conference Proceedings; [2005]; 28 pp.; In English; See also 20050203713; Original contains color and black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Goddard Space Flight Center Spacecraft Magnetic Test Facility (SMTF) was constructed in the 1960's for the purpose of simulating geomagnetic and interplanetary magnetic field environments. The facility includes a three axis Braunbek coil system consisting of 12 loops, 4 loops on each of the three orthogonal axes; a remote Earth field sensing magnetometer and servo controller; and a remote power control and instrumentation building. The inner coils of the Braunbek system are 42-foot in diameter with a 10-foot by 10-foot opening through the outer coils to accommodate spacecraft access into the test volume. The physical size and precision of the facility are matched by only two other such facilities in the world. The facility was used extensively from the late 1960's until the early 1990's when the requirement for spacecraft level testing diminished. New NASA missions planned under the Living with a Star, Solar Terrestrial Probes, Explorer, and New Millennium Programs include precision, high-resolution magnetometers to obtain magnetic field data that is critical to fulfilling their scientific mission. It is highly likely that future Lunar and Martian exploration missions will also use precision magnetometers to conduct geophysical magnetic surveys. To ensure the success of these missions, ground testing using a magnetic test facility such as the GSFC SMTF will be required. This paper describes the history of the facility, the future mission requirements that have renewed the need for spacecraft level magnetic testing, and the plans for restoring the facility to be capable of performing to its original design specifications.

Author

Test Facilities; Interplanetary Magnetic Fields; Geomagnetism; Full Scale Tests; Space Environment Simulation

20050203739 Lockheed Martin Space and Strategic Missiles, Sunnyvale, CA, USA

Environmental Chamber Area (ECA)

Diehl, Manfred; Merrick, Alan; 23rd Space Simulation Conference Proceedings; [2005]; 34 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes a new facility that Lockheed Martin Corp built for the sole purpose of performing thermal and thermal vacuum tests in small chambers. The chambers are not new, but are refurbished chambers brought up to current electrical codes. One of the goals when building this facility was to design out the deficiencies of the previous facility along with merging of the best features of the previous facility.

Author

Test Chambers; Thermal Vacuum Tests; Environmental Tests; Environmental Laboratories

20050203742 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Upgrade of the Goddard Space Flight Center's Mass Properties Measuring Facility

Ross, Brian P.; McLeod, Christopher; 23rd Space Simulation Conference Proceedings; [2005]; 25 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Goddard Space Flight Center has a Mass Properties Measuring Facility (MPMF), which is used to measure weight, center of gravity, moment of inertia, and product of inertia of satellites and space flight hardware. The system was originally purchased more than 30 years ago. While the MPMF was still in good mechanical condition, the measurement and control subsystem had begun to experience more frequent component failures. Many of the outdated, discrete components in the system are no longer available for replacement. A decision was made to upgrade the measurement and control subsystem of the MPMF to improve its reliability and reduce the chance of component failures leading to extended facility outages. This paper will describe details of the upgraded subsystems and summarize the new performance capabilities of the system.

Author

Weight Measurement; Mass; Test Facilities; Upgrading

20050203743 NASA Goddard Space Flight Center, Greenbelt, MD, USA

James Webb Space Telescope (JWST) Integrated Science Instrument Module (ISIM) Cryogenic Component Test Facility

Packard, Edward A.; 23rd Space Simulation Conference Proceedings; [2005]; 41 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation provides information on the design, construction, and operation of a cryogenic chamber, and its use in testing the Integrated Science Instrument Module (ISIM) for the James Webb Space Telescope (JWST).

CASI

Cryogenic Temperature; Test Facilities; Instrument Packages; Spacecraft Instruments; Low Temperature Tests

20050203744 Aerospace Testing Alliance, Arnold AFB, TN, USA, Arnold Engineering Development Center, Arnold AFS, TN, USA

Electric Thruster Backflux and Other Simulated Space Environment Effects in AEDC's CCOSE Chamber

Crider, Dustin; Prebola, John, Jr.; Bertrand, William; Crews, Daniel; 23rd Space Simulation Conference Proceedings; [2005]; 32 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Characterization of Combined Orbital Surface Effects (CCOSE) facility at the Arnold Engineering Development Center AEDC has been developed to provide a combined effects space environment test capability. The Office of the Secretary of Defense (OSD) funded the development of the CCOSE material sample test facility as a prototype for a larger, combined space environment facility. The chamber conducted a successful demonstration test in August 2003 and is currently capable of exposing a sample material to any combination of five elements of the space environment: atomic oxygen, contamination, solar ultraviolet radiation, charge effects, and electric thruster backflux. This paper discusses the current CCOSE demonstration test results, a planned space environment simulation upgrade, and the technical challenges encountered and overcome in the development of the CCOSE facility. In particular, the electric thruster backflux system required the addition of an electrostatic lens system to achieve ion beam focusing and energy control. All electric thruster backflux system

modifications and improvements were verified in a small AEDC research chamber prior to installation on the CCOSE chamber. The final system was installed on the CCOSE chamber and successfully operated during the facility demonstration test to verify CCOSE's ability to simulate the synergistic space environment.

Author

Space Environment Simulation; Test Chambers; Environmental Tests; Test Facilities

15

LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20050200828 Air Force Research Lab., Edwards AFB, CA USA

Arcjet Neutralization of Hall Thrusters. II: Experimental Demonstration

Walker, Quentin E.; Gascon, N.; Cappelli, Mark A.; Hargus, William A., Jr.; Schilling, John A.; Oct. 2003; 29 pp.; In English
Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A435308; AFRL-PR-ED-TP-2003-061; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper examines the use of an arcjet to neutralize Hall thrusters, as such a hybrid arcjet-Hall thruster concept can fill a performance niche amongst available space propulsion options. We report on experiments that determine how much electron current can be drawn to a surrogate anode from the plume of low power arcjets operating on hydrogen and helium, and demonstrate the first successful operation of a low power Hall thruster-arcjet neutralizer package. In the surrogate anode studies, we find that the drawing of current from the arcjet plume has only a weak effect on overall arcjet performance (thrust), with a slight decrease in arc voltage with increased extracted current. A single arcjet-Hall thruster hybrid package was assembled for concept demonstration. When operating on helium with a nominal mass flow rate of 4.5 mg/s and at very low power levels (70-120W), the arcjet was able to effectively neutralize the 200-900W xenon Hall thruster causing little measurable departure from the hollow-cathode neutralized Hall thruster V-I characteristics up to 250V. At higher helium mass flow rates, the Hall discharge current was slightly perturbed from its expected values, most likely due to the ingestion of helium in the chamber background.

DTIC

Arc Jet Engines; Electric Rocket Engines; Hall Thrusters; Propulsion

20050200837 Embry-Riddle Aeronautical Univ., Daytona Beach, FL USA

Analysis of the DEBI Flight Data

Erdman, Peter; Jun. 2005; 5 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0348

Report No.(s): AD-A435347; ERAU-TR-61135; ARO-45790.1-EG; No Copyright; Avail: CASI; [A01](#), Hardcopy

The investigation of hypervelocity shocks that began with the highly successful Bowshock I and II atmospheric sounding rocket experiments continued with the DEBI flight experiment. Instruments aboard the earlier vehicles performed measurements of the ultraviolet and vacuum ultraviolet emission excited in the high temperature gas produced by the shock ahead of the hypervelocity body. With the DEBI experiment, we developed the experimental techniques and the instruments necessary to expand those earlier experiments into the infrared portion of the spectrum where ground-state, molecular, ro-vibrational emission can be observed as the most direct measure of shock temperatures.

DTIC

Bow Waves; Data Processing; Data Reduction; Flight Tests; Hypersonic Flight; Hypervelocity Impact; Shock Wave Interaction; Shock Waves

20050200909 Naval Postgraduate School, Monterey, CA USA

Development of Low-Cost Satellite Control Software

Waterman, Bryan D.; Jun. 2005; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435548; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis details the development and validation procedures of the experiment control software to be used on the NPSAT1. The software developed for a standard Linux kernel instead of an expensive proprietary space computer system includes functions for satellite orbit prediction, precise satellite location, and adaptive experiment scheduling using inputs

from the electrical power system, sub-satellite position, and sub-satellite local time.

DTIC

Artificial Satellites; Computer Programming; Computer Programs; Low Cost; Satellite Control

20050201005 Spectral Sciences, Inc., Burlington, MA USA

High Altitude Chemical Injections: Non-Thermal Chemical Dynamics and Flow Field Modeling

Bernstein, Lawrence; Braunstein, Matthew; Nov. 2004; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-C-0095; Proj-1010

Report No.(s): AD-A435729; SSI-SR-237; AFRL-VS-HA-TR-2004-1202; No Copyright; Avail: Defense Technical Information Center (DTIC)

Near UV OH(A-X) and NH(A-X) emission bands at λ 3100 and 3360 Å, respectively, have been observed in Space Shuttle engine exhaust using the GLO imager spectrograph located in the payload bay. Spectra were collected at a resolution of 4 Å for daytime solar illumination conditions during low-Earth orbit (LEO) maneuvers. While it is now understood that the OH(A-X) emissions stem from solar-induced fluorescence and photodissociation of OH and H₂O in the exhaust (only day phenomenon), respectively, and exhaust H₂O collisions with atmospheric atomic oxygen (night and day), the NH(A-X) emissions have been determined to have a chemical reaction origin, whereby the reactants are not well established. The NH(A-X) band is of particular interest since it radiates in a spectral region where it can be readily observed from the Maui Space Surveillance Site (MSSS). In this analysis, we obtain additional clues with respect to the radiance mechanism by analyzing the temporal variation of the near-UV spectral bands. We discuss here spectral and temporal modeling of GLO measurements of a sequence of near-UV spectra (2 s temporal resolution) recorded during an extended daytime firing of a Shuttle vernier reaction control system (VRCS) engine. In the VRCS engine burn, the spectrum is dominated by the narrow NH(A-X) band. The weaker OH(A-X) band appears to be primarily produced by the reaction of atmospheric O with exhaust H₂O. This is in contrast to our analysis presented at last year's AMOS conference in which the OH emission for a higher-altitude PRCS daytime burn was dominated by solar excitation channels. As discussed here, the relative importance of the solar and reactive pathways is very sensitive to both engine thrust and altitude/atmospheric O density. We also present SOCRATES flow field and chemistry calculations of the NH(A-X) and OH(A-X) emissions.

DTIC

Chemical Reactions; Emission Spectra; Flow Distribution; High Altitude; Injection; Models; Reaction Kinetics

20050201027 Air Force Research Lab., Edwards AFB, CA USA

Properties and Improved Space Survivability of POSS (Polyhedral Oligomeric Silsesquioxane) Polyimides

Tomczak, Sandra J.; Marchant, Darrell; Svejda, Steve; Minton, Timothy K.; Brunsvold, Amy L.; Gouzman, Irina; Grossman, Eitan; Schatz, George C.; Troya, Diego; Sun, LiPeng; Gouzman, Irina; Nov. 2004; 14 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0276; F49620-01-100335; Proj-DARP

Report No.(s): AD-A435770; No Copyright; Avail: CASI; A03, Hardcopy

Kapton polyimide (PI) is widely used on the exterior of spacecraft as a thermal insulator. Atomic oxygen (AO) in lower earth orbit (LEO) causes severe degradation in Kapton resulting in reduced spacecraft lifetimes. One solution is to coat the polymer surface with SiO₂ since this coating is known to impart remarkable oxidation resistance. Imperfections in the SiO₂ application process and micrometeoroid/debris impact in orbit damage the SiO₂ coating, leading to erosion of Kapton. A self passivating, self healing silica layer protecting underlying Kapton upon exposure to AO may result from the nanodispersion of silicon and oxygen within the polymer matrix. Polyhedral oligomeric silsesquioxane (POSS) is composed of an inorganic cage structure with a 2:3 Si:O ratio surrounded by tailorable organic groups and is a possible delivery system for nanodispersed silica. A POSS dianiline was copolymerized with pyromellitic dianhydride and 4,4'-oxydianiline resulting in POSS Kapton Polyimide. The glass transition temperature (T_g) of 5 to 25 weight % POSS Polyimide was determined to be slightly lower, 5 - 10 %, than that of unmodified polyimides (414 °C). Furthermore the room temperature modulus of polyimide is unaffected by POSS, and the modulus at temperatures greater than the T_g of the polyimide is doubled by the incorporation of 20 wt % POSS. To simulate LEO conditions, POSS PI films underwent exposure to a hyperthermal O-atom beam. Surface analysis of exposed and unexposed films conducted with X-ray photoelectron spectroscopy, atomic force microscopy, and surface profilometry support the formation of a SiO₂ self healing passivation layer upon AO exposure. This is exemplified by erosion rates of 10 and 20 weight % POSS PI samples which were 3.7 and 0.98 percent, respectively, of the erosion rate for Kapton H at a fluence of 8.5 x 10²⁰ O atoms/sq cm.

DTIC

Polyimide Resins; Polyimides; Polymeric Films; Silicon Dioxide; Thermal Insulation

20050201054 Massachusetts Inst. of Tech., Cambridge, MA USA

Numerical Treatment of Geophysical Interactions of Electrodynastic Tethers

Sanchez, Martinez; Jul. 2005; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-01-1-0366

Report No.(s): AD-A435809; AFRL-SR-AR-TR-05-0251; No Copyright; Avail: Defense Technical Information Center (DTIC)

This Report summarizes the results achieved during three years under an AFOSR Grant for the development of numerical methods aimed at physical clarification and rational design of Electrodynastic Tethers with electron collection on the bare wire surface. The work was mainly carried out as part of one Doctoral Thesis (Tatsuo Onishi, MIT, Aug. 2002) and three MS Theses (Jean Benoit Ferry, MIT Aero/Astro, Dec. 2004; C.H. Zeineh, MIT Aero/Astro, underway). The original PIC code of Onishi was extended by Ferry, and their results have been documented in our two previous Yearly Reports. During the third year of the Grant, a new and more advanced code by Dr. Oleg Batischev, of our Space Propulsion Lab, was adapted and exploited by J. Marie Deux, whose Thesis is included as part of this Final Report. All the preceding work was aimed at the bare tether electron collection problem, for propulsion and power applications, in addition, work was also initiated by C. Zeineh on the application of high-voltage tethers to Radiation Belt Remediation; a preliminary account of this work (which is being extended under a new AFOSR Grant) is also included in this Report.

DTIC

Geophysics; Numerical Analysis; Tetherlines

20050201077 California Univ., Los Angeles, CA USA

Nozzle Plume Impingement on Spacecraft Surfaces: Effects of Surface Roughness

Lilly, T. C.; Ngalande, C.; Ketsdever, Andrew; Gimelshein, S.; Alexeenko, A.; May 2005; 8 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A435858; No Copyright; Avail: Defense Technical Information Center (DTIC)

An experimental and numerical effort was undertaken to assess the effects of a cold gas ($T_0=300\text{K}$) nozzle plume impinging on a simulated spacecraft surface. The nozzle flow impingement is investigated experimentally using a nano-Newton resolution force balance and numerically using the Direct Simulation Monte Carlo (DSMC) numerical technique. The Reynolds number range investigated in this study is from 0.5 to approximately 900 using helium and nitrogen propellants. The thrust produced by the nozzle was first assessed on a force balance to provide a baseline case. Subsequently, an aluminum plate was attached to the same force balance at various angles from 0° to 90° ; (parallel to the plume flow) to 10° . For low Reynolds number helium flow, a 16.5% decrease in thrust was measured for the plate at 0° relative to the free plume expansion case. For low Reynolds number nitrogen flow, the difference was found to be 12%. The thrust degradation was found to decrease at higher Reynolds numbers and larger plate angles. The roughness of the simulated spacecraft surface will be a variable in the testing to be performed for this manuscript.

DTIC

Cold Gas; Impingement; Plumes; Propellants; Surface Roughness Effects

16

SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety*; *15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20050199623 NASA Johnson Space Center, Houston, TX, USA

STS-114 Flight Day 10 Highlights

August 05, 2005; In English; 39 min., 14 sec. playing time, in color, with sound

Report No.(s): BRF-1438J; No Copyright; Avail: CASI; [V03](#), Videotape-VHS; [B03](#), Videotape-Beta

On Flight Day 10 of the STS-114 mission the International Space Station (ISS) is seen in low lighting while the Space Station Remote Manipulator System (SSRMS), also known as Canadarm 2 grapples the Raffaello Multipurpose Logistics Module (MPLM) in preparation for its undocking the following day. Members of the shuttle crew (Commander Eileen Collins, Pilot James Kelly, Mission Specialists Soichi Noguchi, Stephen Robinson, Andrew Thomas, Wendy Lawrence, and Charles Camarda) and the Expedition 11 crew (Commander Sergei Krikalev and NASA ISS Science Officer and Flight Engineer John Phillips) of the ISS read statements in English and Russian in a ceremony for astronauts who gave their lives. Interview

segments include one of Collins, Robinson, and Camarda, wearing red shirts to commemorate the STS-107 Columbia crew, and one of Collins and Noguchi on board the ISS, which features voice over from an interpreter translating questions from the Japanese prime minister. The video also features a segment showing gap fillers on board Discovery after being removed from underneath the orbiter, and another segment which explains an experimental plug for future shuttle repairs being tested onboard the mid deck.

CASI

Discovery (Orbiter); International Space Station; Spacecrews; Crew Procedures (Inflight)

20050199631 NASA Johnson Space Center, Houston, TX, USA

STS-114 Flight Day 11 Highlights

August 05, 2005; In English; 29 min., 53 sec. playing time, in color, with sound

Report No.(s): BRF-1438K; No Copyright; Avail: CASI; [V02](#), Videotape-VHS; [B02](#), Videotape-Beta

Flight Day 11 begins with the STS-114 crew of Space Shuttle Discovery (Commander Eileen Collins, Pilot James Kelly, Mission Specialists Soichi Noguchi, Stephen Robinson, Andrew Thomas, Wendy Lawrence, and Charles Camarda) awaking to 'Anchors Away,' to signify the undocking of the Raffaello Multipurpose Logistics Module (MPLM) from the International Space Station (ISS). Canadarm 2, the Space Station Remote Manipulator System (SSRMS), retrieves the Raffaello Multipurpose Logistics Module (MPLM) from the nadir port of the Unity node of the ISS and returns it to Discovery's payload bay. The Shuttle Remote Manipulator System (SRMS) hands the Orbiter Boom Sensor System (OBSS) to its counterpart, the SSRMS, for rebearthing in the payload bay as well. The rebearthing of the OBSS is shown in detail, including centerline and split-screen views. Collins sends a message to her husband, and talks with Representative Tom DeLay (R-TX). Earth views include the Amalfi coast of Italy. The ISS control room bids farewell to the STS-114 crew and the Expedition 11 crew (Commander Sergei Krikalev and NASA ISS Science Officer and Flight Engineer John Phillips) of the ISS.

CASI

Discovery (Orbiter); International Space Station; Spacecrews; Space Station Mobile Servicing System; Remote Manipulator System

20050199640 NASA Johnson Space Center, Houston, TX, USA

STS-114 Flight Day 12 Highlights

August 06, 2005; In English; 23 min., 24 sec. playing time, in color, with sound

Report No.(s): BRF-1438L; No Copyright; Avail: CASI; [V02](#), Videotape-VHS; [B02](#), Videotape-Beta

Flight Day 12 features a night undocking of Space Shuttle Discovery (Commander Eileen Collins, Pilot James Kelly, Mission Specialists Soichi Noguchi, Stephen Robinson, Andrew Thomas, Wendy Lawrence, and Charles Camarda) from the International Space Station (ISS). The STS-114 crew and the Expedition 11 crew of the ISS (Commander Sergei Krikalev and NASA ISS Science Officer and Flight Engineer John Phillips) bid each other farewell. Prior to the undocking, Discovery and Mission Control are heard discussing troubleshooting of an oxygen flow sensor. Crew preparations for undocking are also heard. After the spacecraft are shown separating, Collins discusses with Mission Control possible debris seen on a monitor. The video includes several scenes of the ISS from the shuttle orbiter, one with Kazakhstan and another with the Himalayas in the background, and another shot with a hand-held camera by Noguchi. Other Earth views include the Sinai Peninsula and Nile Delta in Egypt, a storm at sea, and a black and white view of the Southern Lights over Australia.

CASI

Discovery (Orbiter); International Space Station; Spacecrews; Spacecraft Docking; Crew Procedures (Inflight); Voice Communication

20050199655 NASA Johnson Space Center, Houston, TX, USA

STS-114 Flight Day 13 Highlights

August 07, 2005; In English; 31 min. playing time, in color, with sound

Report No.(s): BRF-1438M; No Copyright; Avail: CASI; [V03](#), Videotape-VHS; [B03](#), Videotape-Beta

On Flight Day 13, the crew of Space Shuttle Discovery on the STS-114 Return to Flight mission (Commander Eileen Collins, Pilot James Kelly, Mission Specialists Soichi Noguchi, Stephen Robinson, Andrew Thomas, Wendy Lawrence, and Charles Camarda) hear a weather report from Mission Control on conditions at the shuttle's possible landing sites. The video includes a view of a storm at sea. Noguchi appears in front of a banner for the Japanese Space Agency JAXA, displaying a baseball signed by Japanese MLB players, demonstrating origami, displaying other crafts, and playing the keyboard. The primary event on the video is an interview of the whole crew, in which they discuss the importance of their mission, lessons

learned, shuttle operations, shuttle safety and repair, extravehicular activities (EVAs), astronaut training, and shuttle landing. Mission Control dedicates the song 'A Piece of Sky' to the Shuttle crew, while the Earth is visible below the orbiter. The video ends with a view of the Earth limb lit against a dark background.

CASI

Discovery (Orbiter); Spacecrews; Crew Procedures (Inflight); Space Maintenance; Aerospace Safety; Safety Factors

20050201800 Return to Flight Task Group, Washington, DC, USA, Columbia Accident Investigation Board, Arlington, VA, USA

Return to Flight Task Group

July 2005; 220 pp.; In English; No Copyright; Avail: CASI; [A10](#), Hardcopy

It has been 29 months since Columbia was lost over East Texas in February 2003. Seven months after the accident, the Columbia Accident Investigation Board (CAIB) released the first volume of its final report, citing a variety of technical, managerial, and cultural issues within NASA and the Space Shuttle Program. To their credit, NASA offered few excuses, embraced the report, and set about correcting the deficiencies noted by the accident board. Of the 29 recommendations issued by the CAIB, 15 were deemed critical enough that the accident board believed they should be implemented prior to returning the Space Shuttle to flight. Some of these recommendations were relatively easy, most were straightforward, a few bordered on the impossible, and others were largely overcome by events, particularly the decision by the President to retire the Space Shuttle by 2010. The Return to Flight Task Group (RTF TG, or simply, the Task Group) was chartered by the NASA Administrator in July 2003 to provide an independent assessment of the implementation of the 15 CAIB return-to-flight recommendations. An important observation must be stated up-front: neither the CAIB nor the RTF TG believes that all risk can be eliminated from Space Shuttle operations; nor do we believe that the Space Shuttle is inherently unsafe. What the CAIB and RTF TG do believe, however, is that NASA and the American public need to understand the risks associated with space travel, and that NASA must make every reasonable effort to minimize such risk. Since the release of the CAIB report, NASA and the Space Shuttle Program expended enormous effort and resources toward correcting the causes of the accident and preparing to fly again. Relative to the 15 specific recommendations that the CAIB indicated should be implemented prior to returning to flight, NASA has met or exceeded most of them the Task Group believes that NASA met the intent of the CAIB for 12 of these recommendations. The remaining three recommendations were so challenging that NASA could not comply completely with the intent of the CAIB.

Author (revised)

Congressional Reports; NASA Space Programs; Space Transportation System; Manned Space Flight; Aerospace Safety; Safety Management; Safety Factors; Space Shuttles; Project Management; Accident Investigation; Columbia (Orbiter); Discovery (Orbiter)

20050202012 Washington State Univ., Pullman, WA, USA

Packaging Materials for Thermally Processed Foods in Future Space Missions

Tang, Juming; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 20-1 - 20-16; In English; See also 20050202011

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Thermally processed shelf-stable foods are important in International Space Station (ISS) programs and essential to the success of future long-duration manned space missions. NASA uses military MRE pouch material to package thermally processed foods for ISS. But the packaging material for MRE pouches contains aluminum (A1) foil as moisture and oxygen barrier. A1 foils create potential problem for solid waste disposal in long duration missions, adds much weight, and are not compatible with some of the emerging processing technologies. This is a need to explore the use of non-foil materials that can provide designed shelf-life of 3-5 years for future space missions. This report presents a review on the current status of package options for thermally processes shelf-stable foods and provides an assessment on the potential of using commercially available O2 and moisture barrier films as a part of package materials for thermally processed foods in future long-duration manned space missions. Based on several criteria, including potential problem in solid waste disposal, weight, mechanical and barrier properties, as well as commercial readiness, laminated EVOH films and SiOx coated films hold most promise as the future package materials for long-term manned space missions. But as of today, none of the commercial pouch films can provide the required O2 barrier for 3-5 year shelf-life at ambient temperature. Research is needed to investigate the synergistic effects of better engineered laminated structures, shorter processing times at elevated temperature, and controlled storage conditions to meet the requirements of long-duration space missions, especially missions to Mars.

Author

Thermal Stability; Storage Stability; Long Duration Space Flight; Food; International Space Station; Packaging; Service Life

20050202027 Riverside Community Coll., CA, USA

Artificial Neural Network Test Support Development for the Space Shuttle PRCS Thrusters

Lehr, Mark E.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 14-1 - 14-14; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

A significant anomaly, Fuel Valve Pilot Seal Extrusion, is affecting the Shuttle Primary Reaction Control System (PRCS) Thrusters, and has caused 79 to fail. To help address this problem, a Shuttle PRCS Thruster Process Evaluation Team (TPET) was formed. The White Sands Test Facility (WSTF) and Boeing members of the TPET have identified many discrete valve current trace characteristics that are predictive of the problem. However, these are difficult and time consuming to identify and trend by manual analysis. Based on this exhaustive analysis over months, 22 thrusters previously delivered by the Depot were identified as high risk for flight failures. Although these had only recently been installed, they had to be removed from Shuttles OV103 and OV104 for reprocessing, by directive of the Shuttle Project Office. The resulting impact of the thruster removal, replacement, and valve replacement was significant (months of work and hundreds of thousands of dollars). Much of this could have been saved had the proposed Neural Network (NN) tool described in this paper been in place. In addition to the significant benefits to the Shuttle indicated above, the development and implementation of this type of testing will be the genesis for potential Quality improvements across many areas of WSTF test data analysis and will be shared with other NASA centers. Future tests can be designed to incorporate engineering experience via Artificial Neural Nets (ANN) into depot level acceptance of hardware. Additionally, results were shared with a NASA Engineering and Safety Center (NESC) Super Problem Response Team (SPRT). There was extensive interest voiced among many different personnel from several centers. There are potential spin-offs of this effort that can be directly applied to other data acquisition systems as well as vehicle health management for current and future flight vehicles.

Author

Fuel Valves; Extruding; Anomalies; Data Acquisition; Failure; Neural Nets

17

SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20050201890 NASA Glenn Research Center, Cleveland, OH, USA

Command and Control of Space Assets Through Internet-Based Technologies Demonstrated

Foltz, David A.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center successfully demonstrated a transmission-control-protocol/ Internet-protocol- (TCP/IP) based approach to the command and control of on-orbit assets over a secure network. This is a significant accomplishment because future NASA missions will benefit by using Internet-standards-based protocols. Benefits of this Internet-based space command and control system architecture include reduced mission costs and increased mission efficiency. The demonstration proved that this communications architecture is viable for future NASA missions. This demonstration was a significant feat involving multiple NASA organizations and industry. Phillip Paulsen, from Glenn's Project Development and Integration Office, served as the overall project lead, and David Foltz, from Glenn's Satellite Networks and Architectures Branch, provided the hybrid networking support for the required Internet connections. The goal was to build a network that would emulate a connection between a space experiment on the International Space Station and a researcher accessing the experiment from anywhere on the Internet, as shown. The experiment was interfaced to a wireless 802.11 network inside the demonstration area. The wireless link provided connectivity to the Tracking and Data Relay Satellite System (TDRSS) Internet Link Terminal (TILT) satellite uplink terminal located 300 ft away in a parking lot on top of a panel van. TILT provided a crucial link in this demonstration. Leslie Ambrose, NASA Goddard Space Flight Center, provided the TILT/TDRSS support. The TILT unit transmitted the signal to TDRS 6 and was received at the White Sands Second TDRSS Ground Station. This station provided the gateway to the Internet. Coordination also took place at the White Sands station to install a Veridian Firewall and automated security incident measurement (ASIM) system to the Second TDRSS Ground Station Internet gateway. The firewall provides a trusted network for the simulated space experiment. A second Internet connection at the demonstration area was implemented to provide Internet connectivity to a group of workstations to serve as platforms for controlling the simulated space experiment. Installation of this Internet connection was coordinated with an Internet service provider (ISP) and local NASA Johnson Space Center personnel. Not only did this TCP/IP-based architecture prove that a principal investigator on the Internet can securely command and control on-orbit assets, it also demonstrated that valuable

virtual testing of planned on-orbit activities can be conducted over the Internet prior to actual deployment in space.

Author

Command and Control; Internets; Technologies; Satellite Networks; Protocol (Computers)

20050203637 NASA Glenn Research Center, Cleveland, OH, USA

Open Architecture SDR for Space

Smith, Carl; Long, Chris; Liebetreu, John; Reinhart, Richard C.; [2005]; 2 pp.; In English; 1st Space Exploration Conference: Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA

Contract(s)/Grant(s): NNC04CB10C; Copyright; Avail: CASI; [A01](#), Hardcopy

This paper describes an open-architecture SDR (software defined radio) infrastructure that is suitable for space-based operations (Space-SDR). SDR technologies will endow space and planetary exploration systems with dramatically increased capability, reduced power consumption, and significantly less mass than conventional systems, at costs reduced by vigorous competition, hardware commonality, dense integration, reduced obsolescence, interoperability, and software re-use. Significant progress has been recorded on developments like the Joint Tactical Radio System (JTRS) Software Communication Architecture (SCA), which is oriented toward reconfigurable radios for defense forces operating in multiple theaters of engagement. The JTRS-SCA presents a consistent software interface for waveform development, and facilitates interoperability, waveform portability, software re-use, and technology evolution.

Author

Radio Communication; Space Communication

20050203960 NASA Glenn Research Center, Cleveland, OH, USA

Waveguide Power Combiner Demonstration for Multiple High Power Millimeter Wave TWTAs

Wintucky, Edwin G.; Simons, Rainee N.; Lesny, Gary G.; Glass, Jeffrey L.; [2004]; 2 pp.; In English; Fifth IEEE International Vacuum Electronics Conference, 27-29 Apr. 2004, Monterey, CA, USA

Contract(s)/Grant(s): WBS 22-982-10-05

Report No.(s): Paper PL.2; No Copyright; Avail: CASI; [A01](#), Hardcopy

NASA is presently developing nuclear reactor technologies, under Project Prometheus, which will provide spacecraft with greatly increased levels of sustained onboard power and thereby dramatically enhance the capability for future deep space exploration. The first mission planned for use of this high power technology is the Jupiter Icy Moons Orbiter (JIMO). In addition to electric propulsion and science, there will also be unprecedented onboard power available for deep space communications. A 32 GHz transmitter with 1 kW of RF output power is being considered to enable the required very high data transmission rates. One approach to achieving the 1 kW RF power, now being investigated at NASA GRC, is the possible power combining of a number of 100-150 W TWTs now under development. The work presented here is the results of a proof-of-concept demonstration of the power combining Ka-band waveguide circuit design and test procedure using two Ka-band TWTAs (Varian model VZA6902V3 and Logimetrics model A440/KA-1066), both of which were previously employed in data uplink evaluation terminals at 29.36 GHz for the NASA Advanced Communications Technology Satellite (ACTS) program. The characterization of the individual TWTAs and power combining demonstration were done over a 500 MHz bandwidth from 29.1 to 29.6 GHz to simulate the Deep Space Network (DSN) bandwidth of 3.18 to 32.3 GHz. Figures 1-3 show some of the power transfer and gain measurements of the TWTAs using a swept signal generator (Agilent 83640b) for the RF input. The input and output powers were corrected for circuit insertion losses due to the waveguide components. The RF saturated powers of both ACTS TWTAs were on the order of 120 W, which is comparable to the expected output powers of the 32 GHz TWTs. Additional results for the individual TWTAs will be presented (AM/AM, AM/PM conversion and gain compression), some of which were obtained from swept frequency and power measurements using a vector network analyzer. The results for the power combining demonstration as well as a more detailed description of the power combining test circuit and test procedure will also be presented.

Author

Millimeter Waves; Nuclear Reactors; Deep Space Network; Electric Propulsion; Power Gain

SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*; *39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20050199467 NASA Glenn Research Center, Cleveland, OH, USA

CM-2 Environmental/Modal Testing of SPACEHAB Racks

McNelis, Mark E.; Goodnight, Thomas W.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Combined environmental/modal vibration testing has been implemented at the NASA Glenn Research Center's Structural Dynamics Laboratory. The benefits of combined vibration testing are that it facilitates test article modal characterization and vibration qualification testing. The Combustion Module-2 (CM-2) is a space experiment that will launch on shuttle mission STS-107 in the SPACEHAB Research Double Module. The CM-2 flight hardware is integrated into a SPACEHAB single and double rack. CM-2 rack-level combined vibration testing was recently completed on a shaker table to characterize the structure's modal response and verify the random vibration response. Control accelerometers and limit force gauges, located between the fixture and rack interface, were used to verify the input excitation. Results of the testing were used to verify the loads and environments for flight on the shuttles.

Derived from text

Combustion; Vibration; Test Equipment; Environmental Control; Spacecraft Modules

20050201679 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Designing for the Edge of Space and Beyond

Jenkins, Dennis R.; Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight; August 2003, pp. 131-153; In English; See also 20050201673; Copyright; Avail: Other Sources

Despite the fanciful predictions of Eugen Sanger, Wernher von Braun, and a wealth of science fiction novelists, it was not until the mid-1950s that the first piloted spacecraft design was undertaken in earnest. It was the height of the Cold War, and the paranoia that swept the country and the military had resulted in the largest arms race the world had ever seen. In aviation the desire was to go higher, faster, and farther than ever before. In response to a need for basic research into the ever-increasing speeds and altitudes, the National Advisory Committee on Aeronautics (NACA) began preliminary research into a piloted vehicle that could exceed five times the speed of sound. The research was felt necessary to support both unmanned missile programs and the eventual development of hypersonic combat aircraft. Interestingly, the group of researchers that took the lead in developing the concept (led by John V. Becker) at the NACA's Langley Laboratory added a new wrinkle—they wanted to be able to leave the sensible atmosphere for a few minutes in order to gain a preliminary understanding of space flight. At the time it was generally felt that piloted space flight would not take place until the turn of the century, although contemporary science fiction—a genre that enjoyed a resurgence of popularity in the mid-1950s—usually showed it coming much earlier. In fact, many serious researchers believed that the group at Langley should remove the 'space leap' from their concept for a hypersonic research air-lane. However, the basic designs for a very high speed airplane and for one capable of short excursions outside the atmosphere were not radically different, so the capability remained.

Derived from text

Acoustic Velocity; High Speed; Hypersonic Aircraft; Spacecraft Design

20050203719 Johns Hopkins Univ., Laurel, MD, USA

The MESSENGER Visible Imager Thermal Design: Preparing for Operation in Orbit Around Mercury

Williams, Bruce; 23rd Space Simulation Conference Proceedings; [2005]; 30 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The MESSENGER spacecraft will be launch on May 11, 2004 from Cape Kennedy with a final destination of the planet Mercury. The MESSENGER spacecraft will be the first spacecraft to enter orbit around Mercury and the second spacecraft ever to view the planet up close. The MESSENGER spacecraft will be placed in a highly elliptical orbit around Mercury, with an 80-degree inclination. The resulting 12-hour orbit will expose the spacecraft and the attached instruments to the very hot planet. At the planets equator, surface temperatures can exceed 400 degree Celsius (C), while the backside of the planet can be below -150 C. The Mercury Dual Imaging System (MDIS) instrument is the main visible imager on the MESSENGER

spacecraft. The MDIS instrument consists of a wide-angle camera and a narrow-angle camera. The two cameras are mounted on a single-axis gimballed platform allowing the cameras to view a majority of the planet surface. The MDIS instrument is mounted on the Nadir pointing-side of the spacecraft, inside of the Payload Adapter Fitting. Due to the severe thermal environment found in orbit around Mercury, an entirely new thermal design was created for the MDIS instrument. By combining stainless steel diode heat pipes and a specific phase change material, the MDIS CCD s can be maintain below -10 C at all times throughout the mission. This paper will discuss the thermal design created for the MDIS instrument and the series of tests that were performed to qualify the instrument thermal design when the instrument radiators temperatures can exceed 200 C.

Author

Messenger (Spacecraft); Spacecraft Instruments; CCD Cameras; Cooling; Thermal Vacuum Tests

20050203721 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Environmental Test Program for the Mars Exploration Rover Project

Fisher, Terry C.; VanVelzer, Paul L.; 23rd Space Simulation Conference Proceedings; [2005]; 44 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

On June 10 and July 7, 2003 the National Aeronautics and Space Administration (NASA) launched two spacecraft from Cape Canaveral, Florida for a six (6) months flight to the Red Planet, Mars. The two Mars Exploration Rover spacecraft landed safely on the planet in January 2004. Prior to the successful launch, both of the spacecraft were involved in a comprehensive test campaign that included development, qualification, and protoflight test programs. Testing was performed to simulate the environments associated with launch, inter-planetary cruise, landing on the planet and Mars surface operations. Unique test requirements included operating the spacecraft while the chamber pressure was controlled to simulate the decent to the planet from deep space, high impact landing loads and rover operations on the surface of the planet at 8 Torr and -130 C. This paper will present an overview of the test program that included vibration, pyro-shock, landing loads, acoustic noise, thermal vacuum and solar simulation testing at the Jet Propulsion Laboratory (JPL) Environmental Test Laboratory facilities in Pasadena, California.

Author

Mars Roving Vehicles; Environmental Tests; Space Environment Simulation; Mars Environment

20050203723 Spectral Dynamics Corp. of San Diego, CA, USA

Satellite Testing Keys: Accurate Sine Testing with Tracking Filters and Notching

Marraccini, Gary; 23rd Space Simulation Conference Proceedings; [2005]; 39 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper was written to determine what key parameters are used in swept sine testing with a focus on the testing of satellites. The cooperation and communication between the design and test community using a Digital Vibration Control System (DVCS) similar to those manufactured by Spectral Dynamics was important to this process. A survey was completed of associates and the design and test community to understand reasons for using Swept Sine Testing in general with a focus to its use in the development of Satellites. The results of the survey indicated that the design community understood the swept sine test and its basic parameters of test control level, sweep rate and sweep frequency range, as well as use of limit channels and notching for protection of the test article. It was found that this was not generally true of other standard parameters in the swept sine test. Parameters such as processing type, compression rate, loop check and display point per sweep are generally left to the test group to select. Processing types (Broadband RMS - BBRMS, Broadband Peak - BBPK, and Tracking Filter - TF) can affect dramatically the outcome of the swept sine tests. BBPK processing produces the most conservative test, with BBRMS next, and TF the most stressful test. Different types of TFs are discussed, with results that vary from different manufacturers of DVCS controllers. Tracking filters with identical stated bandwidths will vary, sometimes significantly, producing more conservative tests (undertests) than their counterparts. Detailed descriptions of the Swept Sine parameters are presented in the paper, but this is not a substitute for training and understanding all of the sine test parameters used in a sine test on your DVCS. It is recommended that both the Design and Test team fully understand all the test parameters when employing a DVCS for Swept Sine Testing before testing what is usually a very expensive test article.

Derived from text

Artificial Satellites; Sine Waves; Vibration Damping; Vibration Tests; Tracking Filters; Sweep Frequency

20050203725 Lockheed Martin Space Systems Co., Denver, CO, USA

Mass Properties Testing of the Mars Exploration Rover Missions

Greene, Jason; 23rd Space Simulation Conference Proceedings; [2005]; 24 pp.; In English; See also 20050203713; Original contains color illustrations

Contract(s)/Grant(s): LM-1222626; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Lockheed Martin Space Systems Company (LMSSC), Denver under contract to the Jet Propulsion Laboratory (JPL) performed the mass properties testing on the Mars Exploration Rover (MER) missions. This testing was conducted on site at JPL in California and at Kennedy Space Center (KSC) in Florida. Testing was performed at JPL to verify model accuracy, as well as determine any issues that may have affected the mass property measurements at the launch site. The tests at KSC were performed on the Entry Vehicles and on the fully fueled spacecraft configurations of both the Spirit and Opportunity missions. The completion of these tests contributed to the successful launch and subsequent landing of both spacecraft on the surface of Mars in January 2004.

Author

Mars Roving Vehicles; Mass; Weight Measurement

20050203732 ManTech, Inc., Greenbelt, MD, USA

Cryo Testing of The James Webb Space Telescope's Integrated Science Instrument Module

Campen, Julie Van; 23rd Space Simulation Conference Proceedings; [2005]; 18 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Integrated Science Instrument Module (ISIM) of the James Webb Space Telescope will be integrated and tested at the Environmental Test Facilities at Goddard Space Flight Center (GSFC). The cryogenic thermal vacuum testing of the ISIM will be the most difficult and problematic portion of the GSFC Integration and Test flow. The test is to validate the coupled interface of the science instruments and the ISIM structure and to sufficiently stress that interface while validating image quality of the science instruments. The instruments and the structure are not made from the same materials and have different CTE. Test objectives and verification rationale are currently being evaluated in Phase B of the project plan. The test program will encounter engineering challenges and limitations, which are derived by cost and technology many of which can be mitigated by facility upgrades, creative GSE, and thorough forethought. The cryogenic testing of the ISIM will involve a number of risks such as the implementation of unique metrology techniques, mechanical, electrical and optical simulators housed within the cryogenic vacuum environment. These potential risks are investigated and possible solutions are proposed.

Author

James Webb Space Telescope; Instrument Packages; Low Temperature Tests; Cryogenic Temperature; Spacecraft Instruments

20050203740 Johns Hopkins Univ., Laurel, MD, USA

Thermal Vacuum Testing of the MESSENGER Spacecraft

Ercol, Carl J.; 23rd Space Simulation Conference Proceedings; [2005]; 43 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mercury remains the last unexplored of the terrestrial planets. As part of NASA's Discovery program, the MErcury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) mission was conceived to provide a focused scientific investigation of this sweltering world. The spacecraft will perform two Mercury flybys beginning in the year 2007. For the second phase of the MESSENGER mission, the spacecraft will enter Mercury orbit in 2009 and collect data for one Earth year. Despite the harsh Mercury environment and close proximity to the Sun, the MESSENGER Spacecraft uses only a passive cooling system and lacks any high-temperature electronics. Consequently, the performance and durability of its Nextel ceramic fiber sunshade, which protects the spacecraft bus structure and its eight instruments, is essential for mission success. In order to conduct a comprehensive thermal evaluation of the spacecraft and its necessary system-level performance tests, a wide range of predicted flight and on-orbit conditions were produced in the GSFC's SES thermal vacuum chamber in February 2004. The sunshade temperature reached as high as 350 C during the thermal balance and thermal cycle phases of the test, while the chamber walls were cooled to -100 C. This paper provides a summary of the MESSENGER spacecraft thermal vacuum test.

Author

Thermal Vacuum Tests; Messenger (Spacecraft); Shades; Solar Simulation; Thermal Simulation; Space Environment Simulation

20050203748 NASA Glenn Research Center, Cleveland, OH, USA

Rudder/Fin Seals Investigated for the X-38 Re-Entry Vehicle

Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA is developing the X-38 vehicle that will demonstrate the technologies required for a potential crew return vehicle for the International Space Station. This vehicle would serve both as an ambulance for medical emergencies and as an evacuation vehicle for the space station. Control surfaces on the X-38 (body flaps and rudder/fin assemblies) require high temperature seals to limit hot gas ingestion and the transfer of heat to underlying low temperature structures. Working with the NASA Johnson Space Center, the Seals Team at the NASA Glenn Research Center completed a series of tests to further characterize baseline seal designs for the rudder/fin interfaces of the X-38. The structures of the rudder/fin assembly and its associated seals are shown in the preceding illustration. Tests performed at Glenn indicated that exposure of the seals in a compressed state at simulated seal re-entry temperatures resulted in a large permanent set and loss of seal resiliency. This could be of concern because the seals are required to maintain contact with the sealing surfaces while the vehicle goes through the maximum re-entry heating cycle to prevent hot gases from leaking past the seals and damaging interior low-temperature structures. To simulate conditions in which the seals may become unloaded during use, such as when they take on a large permanent set, Glenn researchers performed room temperature flow and compression tests to determine seal flow rates, resiliency, and unit loads under minimal loads. Flow rates through an unloaded (i.e., 0-percent compression) double seal arrangement were twice those of a double seal compressed to the 20-percent design compression level. These flow rates are being used in thermal analyses to predict the effect of flow through the seals on over-all seal temperatures. Compression test results showed that seal unit loads and contact pressures were below the limits that Johnson had set as goals for the seals. In the rudder/fin seal location, the seals are in contact with shuttle thermal tiles and are moved across the tiles as the rudder is rotated during re-entry. Low seal unit loads and contact pressures are required to limit the loads on these tiles and minimize any damage that the seals could cause. A series of tests were performed on these seals in NASA Ames Research Center's arc jet facility. The arc jet facility approximates relevant thermal environments that a seal or other structure would be subjected to during extreme heating conditions such as those experienced during space vehicle re-entry. Eleven tests were completed, including one test in which no seal was installed in the gap to examine the flow of heat down into the gap. The seal was compressed between stationary insulation tiles and a movable elevon that was rotated during the test to deflect the arc jet exhaust into the seal gap. Peak seal temperatures as high as 2000 F were reached during the 5-min tests. Results of these tests indicate satisfactory performance of the seal for single-use (e.g., X-38) applications. The results of these tests were shared with the NASA Johnson Space Center and are being used to validate aerothermostructural analysis codes that predict seal temperatures under these conditions. The tests performed at Glenn have provided valuable information to Johnson about the performance of the seals that they are considering using in the rudder/fin location of the X-38 vehicle. Glenn and Johnson are currently defining what additional work needs to be done to develop the final rudder/fin seal design for the X-38 vehicle.

Author

Fins; Reentry Vehicles; Rudders; Sealing; X-38 Crew Return Vehicle; Aerothermodynamics; Test Facilities

20050203861 NASA Glenn Research Center, Cleveland, OH, USA

Electronics and Sensor Cooling with a Stirling Cycle for Venus Surface Mission

Mellott, Ken; February 13, 2004; 1 pp.; In English; IECEC Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: Other Sources; Abstract Only

The inhospitable ambient surface conditions of Venus, with a 450 C temperature and 92 bar pressure, may likely require any extended-duration surface exploratory mission to incorporate some type of cooling for probe electronics and sensor devices. A multiple-region Venus mission study was completed at NASA GRC in December of 2003 that resulted in the preliminary design of a kinematically-driven, helium charged, Stirling cooling cycle with an estimated over-all COP of 0.376 to lift 100 watts of heat from a 200 C cold sink temperature and reject it at a hot sink temperature of 500 C. This paper briefly describes the design process and also describes and summarizes key features of the kinematic, Stirling cooler preliminary design concept.

Author

Venus Surface; Venus Probes; Spacecraft Electronic Equipment; Cooling Systems; Stirling Cycle

20050203966 NASA Langley Research Center, Hampton, VA, USA

Evaluation of Microbolometer-Based Thermography for Gossamer Space Structures

Miles, Jonathan J.; Blandino, Joseph R.; Jenkins, Christopher H.; Pappa, Richard S.; Banik, Jeremy; Brown, Hunter; McEvoy, Kiley; [2005]; 13 pp.; In English; SPIE Optics and Photonics 2005, 31 Jul. - 4 Aug. 2005, San Diego, CA, USA
Contract(s)/Grant(s): 23-800-92-65

Report No.(s): SPIE Paper 5880-10; Copyright; Avail: CASI; A03, Hardcopy

In August 2003, NASA's In-Space Propulsion Program contracted with our team to develop a prototype on-board Optical Diagnostics System (ODS) for solar sail flight tests. The ODS is intended to monitor sail deployment as well as structural and thermal behavior, and to validate computational models for use in designing future solar sail missions. This paper focuses on the thermography aspects of the ODS. A thermal model was developed to predict local sail temperature variations as a function of sail tilt to the sun, billow depth, and spectral optical properties of front and back sail surfaces. Temperature variations as small as 0.5 C can induce significant thermal strains that compare in magnitude to mechanical strains. These thermally induced strains may result in changes in shape and dynamics. The model also gave insight into the range and sensitivity required for in-flight thermal measurements and supported the development of an ABAQUS-coupled thermo-structural model. The paper also discusses three kinds of tests conducted to 1) determine the optical properties of candidate materials; 2) evaluate uncooled microbolometer-type infrared imagers; and 3) operate a prototype imager with the ODS baseline configuration. (Uncooled bolometers are less sensitive than cooled ones, but may be necessary because of restrictive ODS mass and power limits.) The team measured the spectral properties of several coated polymer samples at various angles of incidence. Two commercially available uncooled microbolometer imagers were compared, and it was found that reliable temperature measurements are feasible for both coated and uncoated sides of typical sail membrane materials.

Author

Spacecraft Structures; Bolometers; Microinstrumentation; Solar Sails; Mathematical Models

20050203978 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA GRC and MSFC Space-Plasma Arc Testing Procedures

Ferguson, Dale C.a; Vayner, Boris V.; Galofaro, Joel T.; Hillard, G. Barry; Vaughn, Jason; Schneider, Todd; [2005]; 1 pp.; In English; 9th Spacecraft Charging Technology Conference, 4-8 Apr. 2005, Tsukuba, Japan; No Copyright; Avail: Other Sources; Abstract Only

Tests of arcing and current collection in simulated space plasma conditions have been performed at the NASA Glenn Research Center (GRC) in Cleveland, Ohio, for over 30 years and at the Marshall Space flight Center (MSFC) for almost as long. During this period, proper test conditions for accurate and meaningful space simulation have been worked out, comparisons with actual space performance in spaceflight tests and with real operational satellites have been made, and NASA has achieved our own internal standards for test protocols. It is the purpose of this paper to communicate the test conditions, test procedures, and types of analysis used at NASA GRC and MSFC to the space environmental testing community at large, to help with international space-plasma arcing testing standardization. To be discussed are: 1. Neutral pressures, neutral gases, and vacuum chamber sizes. 2. Electron and ion densities, plasma uniformity, sample sizes, and Debye lengths. 3. Biasing samples versus self-generated voltages. Floating samples versus grounded. 4. Power supplies and current limits. Isolation of samples from power supplies during arcs. Arc circuits. Capacitance during biased arc-threshold tests. Capacitance during sustained arcing and damage tests. Arc detection. Preventing sustained discharges during testing. 5. Real array or structure samples versus idealized samples. 6. Validity of LEO tests for GEO samples. 7. Extracting arc threshold information from arc rate versus voltage tests. 8 . Snapover and current collection at positive sample bias. Glows at positive bias. Kapton pyrolyzation. 9. Trigger arc thresholds. Sustained arc thresholds. Paschen discharge during sustained arcing. 10. Testing for Paschen discharge thresholds. Testing for dielectric breakdown thresholds. Testing for tether arcing. 11. Testing in very dense plasmas (ie thruster plumes). 12. Arc mitigation strategies. Charging mitigation strategies. Models. 13. Analysis of test results. Finally, the necessity of testing will be emphasized, not to the exclusion of modeling, but as part of a complete strategy for determining when and if arcs will occur, and preventing them from occurring in space.

Author

Space Plasmas; Performance Tests; Dielectrics; Electron Plasma; Dense Plasmas; Standardization

20050203989 NASA Glenn Research Center, Cleveland, OH, USA

Venus Surface Power and Cooling System Design

Landis, Geoffrey A.; Mellott, Kenneth D.; [2004]; 1 pp.; In English; 55th International Astronautical Congress, 4-8 Oct. 2004, Vancouver, Canada

Contract(s)/Grant(s): WBS 22-319-20-B1; No Copyright; Avail: Other Sources; Abstract Only

A radioisotope power and cooling system is designed to provide electrical power for the a probe operating on the surface of Venus. Most foreseeable electronics devices and sensors simply cannot operate at the 450 C ambient surface temperature of Venus. Because the mission duration is substantially long and the use of thermal mass to maintain an operable temperature range is likely impractical, some type of active refrigeration may be required to keep certain components at a temperature below ambient. The fundamental cooling requirements are comprised of the cold sink temperature, the hot sink temperature, and the amount of heat to be removed. In this instance, it is anticipated that electronics would have a nominal operating temperature of 300 C. Due to the highly thermal convective nature of the high-density atmosphere, the hot sink temperature was assumed to be 50 C, which provided a 500 C temperature of the cooler's heat rejecter to the ambient atmosphere. The majority of the heat load on the cooler is from the high temperature ambient surface environment on Venus. Assuming 5 cm radial thickness of ceramic blanket insulation, the ambient heat load was estimated at approximately 77 watts. With an estimated quantity of 10 watts of heat generation from electronics and sensors, and to accommodate some level of uncertainty, the total heat load requirement was rounded up to an even 100 watts. For the radioisotope Stirling power converter configuration designed, the Sage model predicts a thermodynamic power output capacity of 478.1 watts, which slightly exceeds the required 469.1 watts. The hot sink temperature is 1200 C, and the cold sink temperature is 500 C. The required heat input is 1740 watts. This gives a thermodynamic efficiency of 27.48 %. The maximum theoretically obtainable efficiency is 47.52 %. It is estimated that the mechanical efficiency of the power converter design is on the order of 85 %, based on experimental measurements taken from 500 watt power class, laboratory-tested Stirling engines at GRC. The overall efficiency is calculated to be 23.36 %. The mass of the power converter is estimated at approximately 21.6 kg.

Author

Cooling Systems; Venus Surface; Operating Temperature; Systems Engineering; Stirling Cycle; Surface Cooling; Thermodynamic Efficiency

20050203993 Cranfield Univ., Bedford, UK

MUSTANG 0: A Low-cost Technology Demonstration Nanosatellite. Summary of the Group Design Project MSc in Astronautics and Space Engineering 2004/05, Cranfield University

Hobbs, Stephen; July 2005; 84 pp.; In English

Report No.(s): COA-0502; Copyright; Avail: Other Sources

Students of the MSc course in Astronautics and Space Engineering 2004/05 at Cranfield University took Mustang 0 as their group project. This report summarizes their findings. Mustang is a partnership of several groups interested in technology for small spacecraft: Mustang 0 is intended to be a simple spacecraft suitable for technology demonstration (especially highly miniaturized systems based on MEMS or microsystem technology (MST)). A parallel student project took place in the School of Industrial and Manufacturing Science at Cranfield University to investigate MST available from non-space sectors and the qualification process for space hardware. Design studies have been performed for all the spacecraft sub-systems and build on previous work by Mustang partners. The spacecraft designed has a mass of just less than 10 kg, a lifetime of 1 year, is 3-axis controlled, and could be launched to either GTO or LEO. New areas studied this year include software design and operations, and some hardware (the main structure) has been manufactured. The project conclusion is that a low-cost (100k pounds for a flight-ready spacecraft) technology demonstration mission is possible. The Mustang 0 study identifies no fundamental problems, although a significant amount of work remains. Many sub-systems now require prototyping to validate and develop the proposed designs.

Author (revised)

Satellite Design; Nanosatellites; Students; Uk Space Program; University Program; Small Satellite Technology

20050203994 Arizona State Univ., Tempe, AZ, USA

Propellantless AOCS Design for a 160-m, 450-kg Sailcraft of the Solar Polar Imager Mission

Wie, Bong; Thomas, Stephanie; Paluszek, Michael; Murphy, David; May 2005; 25 pp.; In English; 41st AIAA Joint Propulsion Conference, 10-19 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NNM04AB09C

Report No.(s): AIAA Paper 2005-9928; Copyright; Avail: CASI; [A03](#), Hardcopy

An attitude and orbit control system (AOCS) is developed for a 160-m, 450-kg solar sail spacecraft of the Solar Polar Imager (SPI) mission. The SPI mission is one of several Sun- Earth Connections solar sail roadmap missions currently envisioned by NASA. A reference SPI sailcraft consists of a 160-m, 150-kg square solar sail, a 250-kg spacecraft bus, and 50-kg science payloads. The 160-m reference sailcraft has a nominal solar thrust force of 160 mN (at 1 AU), an uncertain center-of-mass/center-of-pressure offset of +/- 0.4 m, and a characteristic acceleration of 0.35 mm/sq s. The solar sail is to be deployed after being placed into an earth escaping orbit by a conventional launch vehicle such as a Delta 11. The SPI sailcraft

first spirals inwards from 1 AU to a heliocentric circular orbit at 0.48 AU, followed by a cranking orbit phase to achieve a science mission orbit at a 75-deg inclination, over a total sailing time of 6.6 yr. The solar sail will be jettisoned after achieving the science mission orbit. This paper focuses on the solar sailing phase of the SPI mission, with emphasis on the design of a reference AOCS consisting of a propellantless primary ACS and a microthruster-based secondary (optional) ACS. The primary ACS employs trim control masses running along mast lanyards for pitch/yaw control together with roll stabilizer bars at the mast tips for quadrant tilt (roll) control. The robustness and effectiveness of such a propellantless primary ACS would be enhanced by the secondary ACS which employs tip-mounted, lightweight pulsed plasma thrusters (PPTs). The microPPT-based ACS is mainly intended for attitude recovery maneuvers from off-nominal conditions. A relatively fast, 70-deg pitch reorientation within 3 hrs every half orbit during the orbit cranking phase is shown to be feasible, with the primary ACS, for possible solar observations even during the 5-yr cranking orbit phase.

Author

Attitude Control; Orbital Maneuvers; Launch Vehicles; Solar Sails; Spacecraft Propulsion

20

SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20050199446 NASA Glenn Research Center, Cleveland, OH, USA

TIGER Burned Brightly in JAMIC

Olson, Sandra L.; Kashiwagi, Takashi; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Transition From Ignition to Flame Growth Under External Radiation in 3D (TIGER- 3D) experiment, which is slated to fly aboard the International Space Station, conducted a series of highly successful tests in collaboration with the University of Hokkaido using Japan's 10-sec JAMIC drop tower. The tests were conducted to test engineering versions of advanced flight diagnostics such as an infrared camera for detailed surface temperature measurements and an infrared spectroscopic array for gas-phase species concentrations and temperatures based on detailed spectral emissions in the near infrared. Shown in the top figure is a visible light image and in the bottom figure is an infrared image at 3.8 mm obtained during the microgravity tests. The images show flames burning across cellulose samples against a slow wind of a few centimeters per second (wind is from right to left). These flow velocities are typical of spacecraft ventilation systems that provide fresh air for the astronauts. The samples are ignited across the center with a hot wire, and the flame is allowed to spread upwind and/or downwind. As these images show, the flames prefer to spread upwind, into the fresh air, which is the exact opposite of flames on Earth, which spread much faster downwind, or with the airflow, as in forest fires.

Derived from text

Flame Propagation; Ignition; Infrared Imagery; Temperature Measurement; Vapor Phases

20050199476 Teledyne Brown Engineering, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Photon Sail History, Engineering, and Mission Analysis

Matloff, Gregory L.; Taylor, Travis; Powell, Conley; September 2004; 61 pp.; In English

Contract(s)/Grant(s): NASA Order H-35191-D; No Copyright; Avail: CASI; [A04](#), Hardcopy

This Appendix summarizes the results of a Teledyne Brown Engineering, Inc. report to the In-Space propulsion research group of the NASA Marshall Space Flight Center (MSFC) that was authored by Taylor et al. in 2003. The subject of this report is the technological maturity, readiness, and capability of the photon solar sail to support space-exploration missions. Technological maturity for solar photon sail concepts is extremely high for rectangular (or square) solar sail configurations due to the historical development of the rectangular design by the NASA Jet Propulsion Laboratory (JPL). L'Garde Inc., ILC Dover Inc., DLR, and many other corporations and agencies. However, future missions and mission analysis may prove that the rectangular sail design is not the best architecture for achieving mission goals. Due to the historical focus on rectangular solar sail spacecraft designs, the maturity of other architectures such as hoop-supported disks, multiple small disk arrays, parachute sails, heliogyro sails, perforated sails, multiple vane sails (such as the Planetary Society's Cosmos 1), inflated pillow sails, etc., have not reached a high level of technological readiness. (Some sail architectures are shown in

Fig. A.1.) The possibilities of different sail architectures and some possible mission concepts are discussed in this Appendix.
Author
Solar Sails; Photons; Space Exploration; Mission Planning; Propulsion

20050201614 Office of Naval Research, Arlington, VA USA

Technical Evaluation Report Meeting on Advanced Rocket Performance Life and Disposal

Derr, Ronald L.; Nov. 2002; 10 pp.; In English

Contract(s)/Grant(s): Proj-DARP

Report No.(s): AD-A435326; AFRL-PR-ED-TP-2002-264; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Specialists' Meeting on Advanced Rocket Performance Life and Disposal was held 23-26 September 2002. This was the second meeting on rocket motors organized by the Applied Vehicle Technology (AVT) Panel since it was created in 1996. The aim of the meeting was achieved in that a snapshot of the state-of-the-art in areas covered by the meeting was accomplished. This evaluation report catalogs results along topic areas defined in an earlier AVT meeting and provides recommendations for future meetings and RTA activities in the area of Rockets and Energetics. The aim of the meeting was to provide a forum in which the latest advances in rocket motor technology could be presented. New propellants were emphasized along with critical operational oriented disciplines such as service life assessment, end of life disposal and environmental impact assessment.

DTIC

Rocket Engines; Service Life; Damage Assessment

20050201631 NASA Glenn Research Center, Cleveland, OH, USA

Modular 5-kW Power-Processing Unit Being Developed for the Next-Generation Ion Engine

Pinero, Luis R.; Bond, Thomas H.; Okada, Don; Phelps, Keith; Pyter, Janusz; Wiseman, Steve; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center is developing a 5- to 10-kW ion engine for a broad range of mission applications. Simultaneously, a 5-kW breadboard power-processing unit (PPU) is being designed and fabricated by Boeing Electron Dynamic Devices, Torrance, California, under contract with Glenn. The beam supply, which processes up to 90 percent of the power into this unit, consists of four 1.1-kW power modules connected in parallel, equally sharing the output current. The modular design allows scalability to higher powers as well as the possibility of implementing an N + 1 redundant beam supply. A novel phaseshifted/pulse-width-modulated, dual full-bridge topology was chosen for this module design for its efficient switching characteristics. A breadboard version of the beam power supply module was assembled. Efficiencies ranging between 91.6 and 96.9 percent were measured for an input voltage range of 80 to 160 V, an output voltage range of 800 to 1500 V, and output powers from 0.3 to 1.0 kW. This beam supply could result in a PPU with a total efficiency between 93 and 95 percent at a nominal input voltage of 100 V. This is up to a 4-percent improvement over the state-of-the-art PPU used for the Deep Space 1 mission. A flight-packaged PPU is expected to weigh no more than 15 kg, which represents a 50-percent reduction in specific mass from the Deep Space 1 design. This will make 5-kW ion propulsion very attractive for many planetary missions.

Author

Ion Engines; Power Conditioning; Fabrication; Power Modules (STS)

20050201632 NASA Glenn Research Center, Cleveland, OH, USA

Deep Space 1 Ion Engine Completed a 3-Year Journey

Sovey, James S.; Patterson, Michael J.; Rawlin, Vincent K.; Hamley, John A.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A xenon ion engine and power processor system, which was developed by the NASA Glenn Research Center in partnership with the Jet Propulsion Laboratory and Boeing Electron Dynamic Devices, completed nearly 3 years of operation aboard the Deep Space 1 spacecraft. The 2.3-kW ion engine, which provided primary propulsion and two-axis attitude control, thrusted for more than 16,000 hr and consumed more than 70 kg of xenon propellant. The Deep Space 1 spacecraft was launched on October 24, 1998, to validate 12 futuristic technologies, including the ion-propulsion system. After the technology validation process was successfully completed, the Deep Space 1 spacecraft flew by the small asteroid Braille on July 29, 1999. The final objective of this mission was to encounter the active comet Borrelly, which is about 6 miles long. The ion engine was on a thrusting schedule to navigate the Deep Space 1 spacecraft to within 1400 miles of the comet. Since the hydrazine used for spacecraft attitude control was in short supply, the ion engine also provided two-axis attitude control to

conserve the hydrazine supply for the Borrelly encounter. The comet encounter took place on September 22, 2001. Dr. Marc Rayman, project manager of Deep Space 1 at the Jet Propulsion Laboratory said, 'Deep Space 1 plunged into the heart of the comet Borrelly and has lived to tell every detail of its spinetingling adventure! The images are even better than the impressive images of comet Halley taken by Europe's Giotto spacecraft in 1986.' The Deep Space 1 mission, which successfully tested the 12 high-risk, advanced technologies and captured the best images ever taken of a comet, was voluntarily terminated on December 18, 2001. The successful demonstration of the 2-kW-class ion propulsion system technology is now providing mission planners with off-the-shelf flight hardware. Higher power, next generation ion propulsion systems are being developed for large flagship missions, such as outer planet explorers and sample-return missions.

Author

Deep Space 1 Mission; Ion Engines; Ion Propulsion; Spacecraft Propulsion

20050201639 NASA Glenn Research Center, Cleveland, OH, USA

Flywheel Charge/Discharge Control Developed

Beach, Raymond.F.; Kenny, Barbara H.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A control algorithm developed at the NASA Glenn Research Center will allow a flywheel energy storage system to interface with the electrical bus of a space power system. The controller allows the flywheel to operate in both charge and discharge modes. Charge mode is used to store additional energy generated by the solar arrays on the spacecraft during insolation. During charge mode, the flywheel spins up to store the additional electrical energy as rotational mechanical energy. Discharge mode is used during eclipse when the flywheel provides the power to the spacecraft. During discharge mode, the flywheel spins down to release the stored rotational energy.

Derived from text

Algorithms; Electricity; Energy Storage; Flywheels; Spacecraft Power Supplies

20050201647 NASA Glenn Research Center, Cleveland, OH, USA

High-Power Electromagnetic Thruster Being Developed

LaPointe, Michael R.; Mikellides, Pavlos G.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

High-power electromagnetic thrusters have been proposed as primary in-space propulsion options for several bold new interplanetary and deep-space missions. As the lead center for electric propulsion, the NASA Glenn Research Center designs, develops, and tests high-power electromagnetic technologies to meet these demanding mission requirements. Two high-power thruster concepts currently under investigation by Glenn are the magnetoplasmadynamic (MPD) thruster and the Pulsed Inductive Thruster (PIT).

Derived from text

Electric Propulsion; Magnetoplasmadynamic Thrusters; Propulsion; Pulsed Inductive Thrusters

20050201665 NASA Glenn Research Center, Cleveland, OH, USA

Next-Generation Ion Propulsion Being Developed

Patterson, Michael J.; Soulas, George C.; Foster, John E.; Haag, Thomas W.; Pinero, Luis R.; Rawlin, Vincent K.; Doehne, S. Michelle; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center ion-propulsion program addresses the need for high specific-impulse systems and technology across a broad range of mission applications and power levels. One activity is the development of the next-generation ion-propulsion system as a follow-on to the successful Deep Space 1 system. The system is envisioned to incorporate a lightweight ion engine that can operate over 1 to 10 kW, with a 550-kg propellant throughput capacity. The engine concept under development has a 40-cm beam diameter, twice the effective area of the Deep Space 1 engine. It incorporates mechanical features and operating conditions to maximize the design heritage established by the Deep Space 1 engine, while incorporating new technology where warranted to extend the power and throughput capability. Prototype versions of the engine have been fabricated and are under test at NASA, with an engineering model version in manufacturing. Preliminary performance data for the prototype engine have been documented over 1.1- to 7.3-kW input power. At 7.3 kW, the engine efficiency is 0.68, at 3615-sec specific impulse. Critical component temperatures, including those of the discharge cathode assembly and magnets, have been documented and are within established limits, with significant margins relative to the Deep Space 1 engine. The 1- to 10-kW ion thruster approach described here was found to provide the needed power and performance improvement to enable important NASA missions. The Integrated In-Space Transportation Planning (IISTP)

studies compared many potential technologies for various NASA, Government, and commercial missions. These studies indicated that a high-power ion propulsion system is the most important technology for development because of its outstanding performance versus perceived development and recurring costs for interplanetary solar electric propulsion missions. One of the best applications of a highpower electric propulsion system was as an integral part of a solar electric propulsion (SEP) stage to send a payload to outer planet targets. The IISTP studies showed that either trip time or launch vehicle class could be significantly reduced when compared with state-of-the-art systems.

Author

Fabrication; Ion Engines; Ion Propulsion; NASA Programs

20050201901 NASA Glenn Research Center, Cleveland, OH, USA

Magnetohydrodynamic MACH Code Used to Simulate Magnetoplasmdynamic Thrusters

Mikellides, Pavlos G.; LaPointe, Michael R.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The On-Board Propulsion program at the NASA Glenn Research Center is utilizing a state-of-the-art numerical simulation to model the performance of high-power electromagnetic plasma thrusters. Such thrusters are envisioned for use in lunar and Mars cargo transport, piloted interplanetary expeditions, and deep-space robotic exploration of the solar system. The experimental portion of this program is described in reference 1. This article describes the numerical modeling program used to guide the experimental research. The synergistic use of numerical simulations and experimental research has spurred the rapid advancement of high-power thruster technologies for a variety of bold new NASA missions. From its inception as a U.S. Department of Defense code in the mid-1980's, the Multiblock Arbitrary Coordinate Hydromagnetic (MACH) simulation tool has been used by the plasma physics community to model a diverse range of plasma problems--including plasma opening switches, inertial confinement fusion concepts, compact toroid formation and acceleration, z-pinch implosion physics, laser-target interactions, and a variety of plasma thrusters. The MACH2 code used at Glenn is a time-dependent, two-dimensional, axisymmetric, multimaterial code with a multiblock structure. MACH3, a more recent three-dimensional version of the code, is currently undergoing beta tests. The MACH computational mesh moves in an arbitrary Lagrangian-Eulerian (ALE) fashion that allows the simulation of diffusive-dominated and dispersive-dominated problems, and the mesh can be refined via a variety of adaptive schemes to capture regions of varying characteristic scale. The mass continuity and momentum equations model a compressible viscous fluid, and three energy equations are used to simulate nonthermal equilibrium between electrons, ions, and the radiation field. Magnetic fields are modeled by an induction equation that includes resistive diffusion, the Hall effect, and a thermal source for magnetic fields. Various models of plasma resistivity are included, along with ablation models and multiport circuit solvers. The set of equations is closed using either an ideal gas or real equation of state.

Author

Magnetohydrodynamics; Magnetoplasmdynamics; Numerical Analysis; Thrusters; Performance Prediction; Electromagnetic Propulsion; Plasmas (Physics)

20050201902 NASA Glenn Research Center, Cleveland, OH, USA, Colorado State Univ., CO, USA

13-kV Ion-Extraction System Being Developed for Inert Gas Ion Engines

Rawlin, Vincent K.; Williams, George J.; Wilbur, Paul; Research and Technology 2001; March 2002; 1 pp.; In English Contract(s)/Grant(s): NAG3-1801; No Copyright; Avail: CASI; [A01](#), Hardcopy

A high-voltage ion optics design was chosen for an assumed outer planet or interstellar precursor mission that would require a long-life, high-power, high-specific-impulse krypton ion engine. Such an engine could support energetic space missions to the outer planets or beyond. Detailed performance and lifetime analyses and several inexpensive subscale grid tests were conducted at the NASA Glenn Research Center and at the Colorado State University under a NASA Glenn grant. A subscale grid set of the selected geometry shown was tested at voltages up to 13,000 V. This yielded a krypton ion beam current that would, when scaled to a full-size 50-cm diameter, produce an ion beam with a power of 30 kW at a specific impulse over 14,000 sec. The operational ion beam focusing limits, as a function of ion current per hole, were found to impose requirements of high uniformity on the discharge chamber plasma density. A full-size set of two-grid, 50-cm-diameter titanium ion optics has been fabricated and awaits testing.

Derived from text

Fabrication; Ion Extraction; Rare Gases; Systems Engineering; Space Missions; Ion Optics

20050201908 NASA Glenn Research Center, Cleveland, OH, USA, Stirling Technology Co., Kennewick, WA, USA, Department of Energy, Washington, DC, USA

Stirling Research Laboratory Providing Independent Performance Verification of Convertors for a Stirling Radioisotope Generator

Thieme, Lanny G.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Department of Energy (DOE), Germantown, Maryland, Stirling Technology Company (STC), Kennewick, Washington, and NASA Glenn Research Center are developing a free-piston Stirling convertor for a high-efficiency Stirling Radioisotope Generator for NASA Space Science missions. This generator is being developed for multimission use, including providing electric power for unmanned Mars rovers and for deep space missions. STC is developing the 55-W Technology Demonstration Convertor (TDC) under contract to DOE. Glenn is conducting an in-house technology project to assist in developing the convertor for readiness for space qualification and mission implementation. As part of this effort, a Stirling Research Laboratory was established to test the TDC's and related technologies. A key task is providing an independent verification and validation of the TDC performance. Four TDC's are now being tested at Glenn. Acceptance testing has been completed for all convertors, and in general, performance agreed well with that achieved by STC prior to the delivery of the convertors. Performance mapping has also been completed on two of the convertors over a range of hot-end temperatures (450 to 650 C), cold-end temperatures (80 to 120 C), and piston amplitudes (5.2 to 6.2 mm). These test data are available online at <http://www.grc.nasa.gov/WWW/tmsb/>. The TDC's can be tested in either a horizontal orientation with dual-opposed convertors or in a vertical orientation with a single convertor. Synchronized dual-opposed pairs are used for dynamically balanced operation that results in very low levels of vibration. The Stirling Research Laboratory also supports launch environment testing of the TDC's in Glenn's Structural Dynamics Laboratory and electromagnetic interference and electromagnetic compatibility characterization and reduction efforts. In addition, the TDC's will be used for long-term endurance testing, and preparations are underway for unattended operation.

Author

Stirling Cycle; Radioisotope Batteries; Spacecraft Power Supplies; Electric Generators

20050201913 Combustion Research and Flow Technology, Inc., Pipersville, PA, USA

Analyses Of Transient Events In Complex Valve and Feed Systems

Ahuja, Vineet; Hosangadi, Ashvin; Cavallo, Peter; Daines, Russell; [2005]; 15 pp.; In English; 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NNS04AA08C

Report No.(s): NASA/NP-2005-06-00064-SSC; Copyright; Avail: CASI; [A03](#), Hardcopy

Valve systems in rocket propulsion systems and testing facilities are constantly subject to dynamic events resulting from the timing of valve motion leading to unsteady fluctuations in pressure and mass flow. Such events can also be accompanied by cavitation, resonance, system vibration leading to catastrophic failure. High-fidelity dynamic computational simulations of valve operation can yield important information of valve response to varying flow conditions. Prediction of transient behavior related to valve motion can serve as guidelines for valve scheduling, which is of crucial importance in engine operation and testing. In this paper, we present simulations of the diverse unsteady phenomena related to valve and feed systems that include valve stall, valve timing studies as well as cavitation instabilities in components utilized in the test loop.

Author

Rocket Engines; Valves; Cavitation Flow; Complex Systems; Engine Tests; Vibration

20050203763 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Orbiter Sample Return Power Design

Mardesich, N.; Dawson, S.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 238-241; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Mars has greatly intrigued scientists and the general public for many years because, of all the planets, its environment is most like Earth's. Many scientists believe that Mars once had running water, although surface water is gone today. The planet is very cold with a very thin atmosphere consisting mainly of CO₂. Mariner 4, 6, and 7 explored the planet in flybys in the 1960s and by the orbiting Mariner 9 in 1971. NASA then mounted the ambitious Viking mission, which launched two orbiters and two landers to the planet in 1975. The landers found ambiguous evidence of life. Mars Pathfinder landed on the planet on July 4, 1997, delivering a mobile robot rover that demonstrated exploration of the local surface environment. Mars Global Surveyor is creating a highest-resolution map of the planet's surface. These prior and current missions to Mars have paved the way for a complex Mars Sample Return mission planned for 2003 and 2005. Returning surface samples from Mars will

necessitate retrieval of material from Mars orbit. Sample mass and orbit are restricted to the launch capability of the Mars Ascent Vehicle. A small sample canister having a mass less than 4 kg and diameter of less than 16 cm will spend from three to seven years in a 600 km orbit waiting for retrieval by a second spacecraft consisting of an orbiter equipped with a sample canister retrieval system, and a Earth Entry Vehicle. To allow rapid detection of the on-orbit canister, rendezvous, and collection of the samples, the canister will have a tracking beacon powered by a surface mounted solar array. The canister must communicate using RF transmission with the recovery vehicle that will be coming in 2006 or 2009 to retrieve the canister. This paper considers the aspect and conclusion that went into the design of the power system that achieves the maximum power with the minimum risk. The power output for the spherical orbiting canister was modeled and plotted in various views of the orbit by the Satellite Orbit Analysis Program (SOAP).

Author

Mars Sample Return Missions; Spacecraft Power Supplies; Planetary Orbits; Orbital Rendezvous; Solar Arrays; Recoverable Spacecraft

20050203774 ITN Energy Systems, Inc., Wheat Ridge, CO, USA

Advanced Flexible Solar Array Program

Meyers, Peter V.; Fabick, Leon; Reinhardt, Kitt C.; Shafarman, William N.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 230-237; In English; See also 20050203753; Original contains black and white illustrations Contract(s)/Grant(s): F29601-98-C-0220; NIST-70NANB8H4070; No Copyright; Avail: CASI; [A02](#), Hardcopy

Increased specific power (W/kg) solar arrays are needed for next-generation military and commercial spacecraft to enable greater payload mass and power budgets, and possibly more satellites per launch. Researchers from ITN Energy Systems (ITN), Global Solar Energy (GSE) and the Institute of Energy Conversion (IEC), with support from the Air Force Research Laboratory (AFRL), are developing polycrystalline thin-film multijunction photovoltaic (PV) modules for space power applications under the Advanced Flexible Solar Array (AFSA) program. Complementary support is provided by the Advanced Technology Program for Premium Power directed toward tandem PV devices. Two-terminal, two-junction tandem PV cells deposited onto lightweight flexible substrates have good potential to achieve PV blanket efficiency of 15% (AM0) and specific power greater than 1000 W/kg. Combined with ITN's innovative solar array pantograph deployment/support structure, the specific power goal for the flexible thin-film solar array under development is 150 W/kg.

Author (revised)

Spacecraft Power Supplies; Solar Arrays; Flexible Bodies

20050203778

ESA Solar Generator Technology Programme

Signorini, Carla; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 13-25; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

This viewgraph presentation provides an overview of spacecraft solar power research and development activities currently conducted by the European Space Agency (ESA). The topics addressed include thin film and cascade solar cells, and solar arrays.

CASI

European Space Agency; Research and Development; Solar Generators; Technology Assessment

20050203813 NASA Glenn Research Center, Cleveland, OH, USA

Environmental Durability of Coated GRCop-84 Copper Alloys

Raj, Sai V.; Robinson, C.; Barrett, C.; Humphrey, D.; [2005]; 1 pp.; In English; 2005 TMS Annual Meeting, 13-17 Feb. 2005, San Francisco, CA, USA

Contract(s)/Grant(s): 22-794-20-77; No Copyright; Avail: Other Sources; Abstract Only

An advanced Cu-8(at.%)Cr-4%Nb alloy developed at NASA's Glenn Research Center, and designated as GRCop-84, is currently being considered for use as liners in combustor chambers and nozzle ramps in NASA's future generations of reusable launch vehicles (RLVs). However, past experience has shown that unprotected copper alloys undergo an environmental attack called 'blanching' in rocket engines using liquid hydrogen as fuel and liquid oxygen as the oxidizer. Potential for sulfidation attack of the liners in hydrocarbon-fueled engines is also of concern. As a result, protective overlay coatings alloys are being developed for GRCop-84. The oxidation behavior of several new coating alloys has been evaluated. GRCop-84 specimens were coated with several copper and nickel-based coatings, where the coatings were deposited by either vacuum plasma spraying or cold spraying techniques. Coated and uncoated specimens were thermally cycled in a furnace at different

temperatures in order to evaluate the performance of the coatings. Additional studies were conducted in a high pressure burner rig using a hydrocarbon fuel and subjected to a high heat flux hydrogen-oxygen combustion flame in NASA's Quick Access Rocket Exhaust (QARE) rig. The performance of these coatings are discussed.

Author

Copper Alloys; Durability; Coatings; Combustion Chambers; Reusable Launch Vehicles; Rocket Engines; Liquid Hydrogen; Liquid Oxygen

20050203843 NASA Glenn Research Center, Cleveland, OH, USA

Analytic Modeling of the Hydrodynamic, Thermal, and Structural Behavior of Foil Thrust Bearings

Bruckner, Robert J.; DellaCorte, Christopher; Pahl, Joseph M.; June 2005; 19 pp.; In English; 2005 Annual Meeting and Exhibition, 60th Society of Tribologists and Lubrication Engineers, 15-19 May 2005, Las Vegas, NV, USA

Contract(s)/Grant(s): WBS 973-80-10

Report No.(s): NASA/TM-2005-213811; E-15168; No Copyright; Avail: CASI; [A03](#), Hardcopy

A simulation and modeling effort is conducted on gas foil thrust bearings. A foil bearing is a self acting hydrodynamic device capable of separating stationary and rotating components of rotating machinery by a film of air or other gaseous lubricant. Although simple in appearance these bearings have proven to be complicated devices in analysis. They are sensitive to fluid structure interaction, use a compressible gas as a lubricant, may not be in the fully continuum range of fluid mechanics, and operate in the range where viscous heat generation is significant. These factors provide a challenge to the simulation and modeling task. The Reynolds equation with the addition of Knudsen number effects due to thin film thicknesses is used to simulate the hydrodynamics. The energy equation is manipulated to simulate the temperature field of the lubricant film and combined with the ideal gas relationship, provides density field input to the Reynolds equation. Heat transfer between the lubricant and the surroundings is also modeled. The structural deformations of the bearing are modeled with a single partial differential equation. The equation models the top foil as a thin, bending dominated membrane whose deflections are governed by the biharmonic equation. A linear superposition of hydrodynamic load and compliant foundation reaction is included. The stiffness of the compliant foundation is modeled as a distributed stiffness that supports the top foil. The system of governing equations is solved numerically by a computer program written in the Mathematica computing environment. Representative calculations and comparisons with experimental results are included for a generation I gas foil thrust bearing.

Author

Foil Bearings; Hydrodynamics; Mathematical Models; Structural Analysis; Computerized Simulation; Thrust Bearings

20050203854 NASA Glenn Research Center, Cleveland, OH, USA, Boeing Co., USA

Brayton Power Conversion System Study to Advance Technology Readiness for Nuclear Electric Propulsion

Allen, Bog; Delventhal, Rex; Frye, Patrick; [2004]; 1 pp.; In English; Space 2004 Conference, Sep. 2004, Providence, RI, USA

Contract(s)/Grant(s): NAS3-02204; No Copyright; Avail: Other Sources; Abstract Only

Recently, there has been significant interest within the aerospace community to develop space based nuclear power conversion technologies especially for exploring the outer planets of our solar system where the solar energy density is very low. To investigate these technologies NASA awarded several contracts under Project Prometheus, the Nuclear Systems Program. The studies described in this paper were performed under one of those contracts, which was to investigate the use of a nuclear power conversion system based on the closed Brayton cycle (CBC). The investigation performed included BPCS (Brayton Power Conversion System) trade studies to minimize system weight and radiator area and advance the state of the art of BPCS technology. The primary requirements for studies were a power level of 100 kWe (to the PPU), a low overall power system mass and a lifetime of 15 years (10 years full power). For the radiation environment, the system was to be capable of operation in the generic space environment and withstand the extreme environments surrounding Jupiter. The studies defined a BPCS design traceable to NEP (Nuclear Electric Propulsion) requirements and suitable for future missions with a sound technology plan for technology readiness level (TRL) advancement identified. The studies assumed a turbine inlet temperature approx. 100 C above the current the state of the art capabilities with materials issues and related development tasks identified. Analyses and evaluations of six different HRS (heat rejection system) designs and three primary power management and distribution (PMAD) configurations will be discussed in the paper.

Author

Brayton Cycle; Nuclear Electric Propulsion; Nuclear Electric Power Generation

20050203858 NASA Stennis Space Center, Stennis Space Center, MS, USA

Large Liquid Rocket Testing: Strategies and Challenges

Rahman, Shamim A.; Hebert, Bartt J.; [2005]; 16 pp.; In English; Joint Propulsion Conference and Exhibit, 10-13 Jul, 2005, Tucson, AZ, USA

Report No.(s): AIAA Paper 2005-3564; SSTI-2200-0048; No Copyright; Avail: CASI; [A03](#), Hardcopy

Rocket propulsion development is enabled by rigorous ground testing in order to mitigate the propulsion systems risks that are inherent in space flight. This is true for virtually all propulsive devices of a space vehicle including liquid and solid rocket propulsion, chemical and non-chemical propulsion, boost stage and in-space propulsion and so forth. In particular, large liquid rocket propulsion development and testing over the past five decades of human and robotic space flight has involved a combination of component-level testing and engine-level testing to first demonstrate that the propulsion devices were designed to meet the specified requirements for the Earth to Orbit launchers that they powered. This was followed by a vigorous test campaign to demonstrate the designed propulsion articles over the required operational envelope, and over robust margins, such that a sufficiently reliable propulsion system is delivered prior to first flight. It is possible that hundreds of tests, and on the order of a hundred thousand test seconds, are needed to achieve a high-reliability, flight-ready, liquid rocket engine system. This paper overviews aspects of earlier and recent experience of liquid rocket propulsion testing at NASA Stennis Space Center, where full scale flight engines and flight stages, as well as a significant amount of development testing has taken place in the past decade. The liquid rocket testing experience discussed includes testing of engine components (gas generators, preburners, thrust chambers, pumps, powerheads), as well as engine systems and complete stages. The number of tests, accumulated test seconds, and years of test stand occupancy needed to meet varying test objectives, will be selectively discussed and compared for the wide variety of ground test work that has been conducted at Stennis for subscale and full scale liquid rocket devices. Since rocket propulsion is a crucial long-lead element of any space system acquisition or development, the appropriate plan and strategy must be put in place at the outset of the development effort. A deferment of this test planning, or inattention to strategy, will compromise the ability of the development program to achieve its systems reliability requirements and/or its development milestones. It is important for the government leadership and support team, as well as the vehicle and propulsion development team, to give early consideration to this aspect of space propulsion and space transportation work.

Author

Engine Tests; Propulsion System Performance; Liquid Propellant Rocket Engines; Thrust Chambers; Performance Tests

20050203878 ATK-Thiokol Propulsion, Brigham City, UT USA

Automated Fluid-Structure Interaction Analysis

Isaac, Daron; Iverson, Michael; Feb. 2003; 15 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0002; Proj-1011

Report No.(s): AD-A435321; No Copyright; Avail: CASI; [A03](#), Hardcopy

An automated Fluid-Structure Interaction (FSI) analysis procedure has been developed at ATK Thiokol Propulsion that couples computational fluid dynamics (CFD) and structural finite element (FE) analysis to solve FSI problems. The procedure externally couples a steady-state CFD analysis using Fluent and a structural FE analysis using ABAQUS. Pressure results from the CFD solution are interpolated and applied as pressure boundary conditions on the structural model. Displacements from the structural analysis are interpolated and applied to the boundary of the CFD mesh. Iteration between the CFD and the structural analysis continues until a solution is reached. The FSI procedure provides controls to monitor the solution and define termination criteria, as well as manage output. Automatic report generation of the solution is another feature of the FSI procedure. Plans and funding are in place to extend the FSI procedure to include coupling with thermal analysis as well.

DTIC

Fluids; Structural Analysis; Thermal Analysis

20050203965 NASA Langley Research Center, Hampton, VA, USA

In-Vacuum Photogrammetry of a 10-Meter Solar Sail

Meyer, Chris G.; Jones, Thomas W.; Lunsford, Charles B.; Pappa, Richard S.; [2005]; 12 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-800-92-65

Report No.(s): AIAA Paper 2005-1889; Copyright; Avail: CASI; [A03](#), Hardcopy

In July 2004, a 10-meter solar sail structure developed by L Garde, Inc. was tested in vacuum at the NASA Glenn 30-meter Plum Brook Space Power Facility in Sandusky, Ohio. The three main objections of the test were to demonstrate

unattended deployment from a stowed configuration, to measure the deployed shape of the sail at both ambient and cryogenic room temperatures, and to measure the deployed structural dynamic characteristics (vibration modes). This paper summarizes the work conducted to fulfill the second test objective. The deployed shape was measured photogrammetrically in vacuum conditions with four 2-megapixel digital video cameras contained in custom made pressurized canisters. The canisters included high-intensity LED ring lights to illuminate a grid of retroreflective targets distributed on the solar sail. The test results closely matched pre-test photogrammetry numerical simulations and compare well with ABAQUS finite-element model predictions.

Author

Photogrammetry; Solar Sails; Vacuum Chambers; Test Facilities

20050203977 NASA Marshall Space Flight Center, Huntsville, AL, USA

Certification Testing Approach for Propulsion System Design

Rodriguez, Henry; Popp, Chris; [2005]; 11 pp.; In English; 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 10-13 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NAS8-02070

Report No.(s): AIAA Paper 2005-4314; Copyright; Avail: CASI; [A03](#), Hardcopy

The Certification of Propulsion Systems is costly and complex which involves development and qualification testing. The desire of the certification process is to assure all requirements can be demonstrated to be compliant. The purpose of this paper is to address the technical design concerns of certifying a system for flight. The authors of this paper have experience the lessons learned from supporting the Shuttle Program for Main Propulsion and On Orbit Propulsions Systems. They have collaborated design concerns for certifying propulsion systems. Presented are Pressurization, Tankage, Feed System and Combustion Instability concerns. Propulsion System Engineers are challenged with the dilemma for testing new systems to specific levels to reduce risk yet maintain budgetary targets. A methodical approach is presented to define the types of test suitable to address the technical issues for qualifying systems for retiring the risk levels.

Author

Systems Engineering; Propulsion System Configurations; Certification

20050203979 Science Applications International Corp., Huntsville, AL, USA

Interplanetary Sample Return Missions Using Radioisotope Electric Propulsion

Williams, R.; Gao, Y.; Kluever, C. A.; Capples, M.; Belcher, J.; May 26, 2005; 11 pp.; In English; 41st AIAA Joint Propulsion Conference, 10-13 Jul. 2005, Tucson, AZ, USA; Copyright; Avail: CASI; [A03](#), Hardcopy

Solar electric propulsion (SEP) is being used for a variety of planetary missions sponsored by ESA, JAXA, and NASA and nuclear electric propulsion (NEP) is being considered for future, flagship-class interplanetary missions. Radioisotope electric propulsion (REP) has recently been shown to effectively complement SEP and NEP for missions to high-AU targets with modest payload requirements. This paper investigates the application of an advanced REP for a sample return from the comet Tempel 1. A set of mission and system parameters are varied with the goal of quantifying their impact on total mission payload. Mission parameters considered include trip-time and Earth return entry interface speed of the sample return system. System parameters considered include launch vehicle, power level of spacecraft at beginning of mission, and thruster specific impulse. For the baseline case of Atlas 401 and REP power level of 750 W, the mission time was 12 years, the payload was 144 kg, and the missions optimized to a single specific impulse generally within Hall ion thruster range. Other cases were investigated in support of graduate studies, and include the larger Atlas 551 launch vehicle and extended power level to 1 kW. The Atlas 551 cases tended to optimize dual specific impulses generally in the Hall ion thruster range for both legs of the mission. A power level of at least 1-kW and trip-time of approximately 11 years was required to obtain a total science payload close to 320 kg for the Atlas 401 launch vehicle. An Atlas 551 launch vehicle yielded a science payload of approximately 540 kg for the case of 1-kW of power and an 11-year trip time, and nearly 250 kg of science payload for the case of 1-kW of power and a 6-year trip time. Results are also reported indicating the performance ramifications of meeting a reduced Earth entry interface velocity constraint.

Author

Sample Return Missions; Tempel 1 Comet; Radioactive Isotopes; Nuclear Electric Propulsion; Solar Electric Propulsion; Interplanetary Spacecraft

20050203986 NASA Glenn Research Center, Cleveland, OH, USA

Power System for Venus Surface Exploration

Landis, Geoffrey A.; Mellott, Kenneth; July 10, 2002; 1 pp.; In English; Seventh European Space Power Conference, 9-13 May 2005, Como, Italy

Contract(s)/Grant(s): WBS 22-319-20-B1; No Copyright; Avail: Other Sources; Abstract Only

A radioisotope power and cooling system is designed to provide electrical power for a probe operating on the surface of Venus. Most foreseeable electronics devices and sensors cannot operate at the 450 C ambient surface temperature of Venus. Because the mission duration is substantially long and the use of thermal mass to maintain an operable temperature range is likely impractical, some type of active refrigeration may be required to keep electronic components at a temperature below ambient. The fundamental cooling parameters are the cold sink temperature, the hot sink temperature, and the amount of heat to be removed. In this instance, it is anticipated that electronics would have a nominal operating temperature of 300 C. Due to the highly thermal convective nature of the high-density (90 bar CO₂) atmosphere, the hot sink temperature was assumed to be 50 C, which provided a 500 C temperature of the cooler's heat rejecter to the ambient atmosphere. The majority of the heat load on the cooler is from the high temperature ambient surface environment on Venus, with a small contribution of heat generation from electronics and sensors. Both thermoelectric (RTG) and dynamic power conversion systems were analyzed, based on use of a standard isotope (General-purpose heat source, or GPHS) brick. For the radioisotope Stirling power converter configuration designed, the Sage model predicts a thermodynamic power output capacity of 478.1 watts, which slightly exceeds the required 469.1 watts. The hot sink temperature is 1200 C, and the cold sink temperature is 500 C. The required heat input is 1740 watts. This gives a thermodynamic efficiency of 27.48 %. It is estimated that the mechanical efficiency of the power converter design is on the order of 85 %, based on experimental measurements taken from 500-watt power class, laboratory-tested Stirling engines. The overall efficiency is calculated to be 23.36 %. The mass of the power converter is estimated at approximately 21.6 kg. Additional information is included in the original extended abstract.

Author (revised)

Venus Probes; Spacecraft Power Supplies; Venus Surface; Radioisotope Batteries; High Temperature Environments; Spacecraft Radiators; Cooling Systems; Stirling Engines

20050203997 NASA Glenn Research Center, Cleveland, OH, USA

Refractive Secondary Solar Concentrator Demonstrated High-Temperature Operation

Wong, Wayne A.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Space applications that utilize solar thermal energy--such as electric power conversion systems, thermal propulsion systems, and furnaces--require highly efficient solar concentration systems. The NASA Glenn Research Center is developing the refractive secondary concentrator, which uses refraction and total internal reflection to efficiently concentrate and direct solar energy. When used in combination with advanced lightweight primary concentrators, such as inflatable thin films, the refractive secondary concentrator enables very high system concentration ratios and very high temperatures. Last year, Glenn successfully demonstrated a secondary concentrator throughput efficiency of 87 percent, with a projected efficiency of 93 percent using an antireflective coating. Building on this achievement, Glenn recently successfully demonstrated high-temperature operation of the secondary concentrator when it was used to heat a rhenium receiver to 2330 F. The high-temperature demonstration of the concentrator was conducted in Glenn's 68-ft long Tank 6 thermal vacuum facility equipped with a solar simulator. The facility has a rigid panel primary concentrator that was used to concentrate the light from the solar simulator onto the refractive secondary concentrator. NASA Marshall Space Flight Center provided a rhenium cavity, part of a solar thermal propulsion engine, to serve as the high-temperature receiver. The prototype refractive secondary concentrator, measuring 3.5 in. in diameter and 11.2 in. long, is made of single-crystal sapphire. A water-cooled splash shield absorbs spillage light outside of the 3.5-in. concentrator aperture. Multilayer foil insulation composed of tungsten, molybdenum, and niobium is used to minimize heat loss from the high-temperature receiver. A liquid-cooled canister calorimeter is used to measure the heat loss through the multilayer foil insulation.

Author

Solar Collectors; Solar Thermal Propulsion; Thermal Energy; Solar Energy; Refractivity; Propulsion System Configurations; Concentrators; High Temperature

20050203998 NASA Glenn Research Center, Cleveland, OH, USA

Active Control of Combustor Instability Shown to Help Lower Emissions

DeLaat, John C.; Chang, Clarence T.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

In a quest to reduce the environmental impact of aerospace propulsion systems, extensive research is being done in the

development of lean-burning (low fuel-to-air ratio) combustors that can reduce emissions throughout the mission cycle. However, these lean-burning combustors have an increased susceptibility to thermoacoustic instabilities, or high-pressure oscillations much like sound waves, that can cause severe high-frequency vibrations in the combustor. These pressure waves can fatigue the combustor components and even the downstream turbine blades. This can significantly decrease the safe operating life of the combustor and turbine. Thus, suppression of the thermoacoustic combustor instabilities is an enabling technology for lean, low-emissions combustors. Under the Aerospace Propulsion and Power Base Research and Technology Program, the NASA Glenn Research Center, in partnership with Pratt & Whitney and United Technologies Research Center, is developing technologies for the active control of combustion instabilities. With active combustion control, the fuel is pulsed to put pressure oscillations into the system. This cancels out the pressure oscillations being produced by the instabilities. Thus, the engine can have lower pollutant emissions and long life. The use of active combustion instability control to reduce thermo-acoustic-driven combustor pressure oscillations was demonstrated on a single-nozzle combustor rig at United Technologies. This rig has many of the complexities of a real engine combustor (i.e., an actual fuel nozzle and swirler, dilution cooling, etc.). Control was demonstrated through modeling, developing, and testing a fuel-delivery system able to the 280-Hz instability frequency. The preceding figure shows the capability of this system to provide high-frequency fuel modulations. Because of the high-shear contrarotating airflow in the fuel injector, there was some concern that the fuel pulses would be attenuated to the point where they would not be effective for control. Testing in the combustor rig showed that open-loop pulsing of the fuel was, in fact, able to effectively modulate the combustor pressure. To suppress the combustor pressure oscillations due to thermoacoustic instabilities, it is desirable to time the injection of the fuel so that it interferes with the instability. A closed-loop control scheme was developed that uses combustion pressure feedback and a phase-shifting controller to time the fuel-injection pulses. Some suppression of the pressure oscillations at the 280-Hz instability frequency was demonstrated (see the next figure). However, the overall peak-to-peak pressure oscillations in the combustor were only mildly reduced. Improvements to control hardware and control methods are being continued to gain improved closed-loop reduction of the pressure oscillations. pulse the fuel at

Author

Active Control; Combustion Control; Fuel-Air Ratio; Feedback Control

23

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20050199458 NASA Glenn Research Center, Cleveland, OH, USA

Experiments Developed to Study Microgravity Smoldering Combustion

Vergili, Franklin; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The overall objective of the Microgravity Smoldering Combustion (MSC) research program is to understand and predict smoldering combustion under normal and microgravity (near-zero-gravity) conditions to help prevent and control smolder-originated fires, in both environments. Smoldering is defined as a nonflaming, self-sustaining, propagating, exothermic surface reaction. If a material is sufficiently permeable, smoldering is not confined to its outer surface, but can propagate as a reaction wave through the interior of the material. The MSC program will accomplish its goals by conducting smolder experiments on the ground and in a space-based laboratory, and developing theoretical models of the process. Space-based experiments are necessary because smoldering is a very slow process and, consequently, its study in a microgravity environment requires extended periods of time that can only be achieved in space. Smoldering can occur in a variety of processes ranging from the smolder of porous insulating materials to underground coal combustion. Many materials can sustain smoldering, including wood, cloth, foams, tobacco, other dry organic materials, and charcoal. The ignition, propagation, transition to flaming, and extinction of the smolder reaction are controlled by complex, thermochemical mechanisms that are not well understood. As with many forms of combustion, gravity affects the availability of the oxidizer and the transport of heat, and therefore, the rate of combustion. The smoldering combustion of porous materials has been studied both experimentally and theoretically, usually in the context of fire safety. Smoldering encompasses a number of fundamental processes, including heat and mass transfer in a porous media; endothermic pyrolysis of combustible material; ignition, propagation, and extinction of heterogeneous exothermic reactions at the solid-gas pore interface; and the onset of gas phase reactions (flaming) from existing surface reactions. Smoldering presents a serious fire risk because the combustion

can propagate slowly in a material's interior and go undetected for long periods of time. It typically yields a substantially higher conversion of fuel to toxic compounds than does flaming (though more slowly), and may undergo a sudden transition to flaming.

Author

Smoldering; Microgravity; Combustion; Exothermic Reactions; Fire Prevention; Thermochemistry; Surface Reactions

20050199682 Environmental Protection Agency, Washington, DC USA

Toxic Substances Control Act (TSCA): ASCII Text Data, July 2005, PMN Number to EPA Accession Number Link (Raw Data on CD-ROM)

Jul. 01, 2005; In English

Report No.(s): PB2005-500162; No Copyright; Avail: National Technical Information Service (NTIS)

The TSCA Chemical Substance Inventory provides chemical identity information for the non-confidential substances on the TSCA Master Inventory File. The datafile contains no TSCA Confidential Business Information. New versions of the TSCA Inventory are issued at approximately six month intervals. The data provided for each chemical substance include the CAS Registry Number, Preferred CA Index Name, molecular formula, and other appropriate information, such as valid chemical names reported by submitters. The entries are in ascending CAS Registry Number order. The PMN Number to EPA Accession Number Link provides a cross-reference of these number for commenced PMNs on the confidential portion of the TSCA Master Inventory File. Neither this cross-reference nor the additional information included is TSCA Confidential Business Information.

NTIS

CD-ROM; Inventories; Texts; Toxicity

20050199693 Pacific Northwest National Lab., Richland, WA, USA

Computational Design of Metal Ion Sequestering Agents

Hay, B. P.; Rapko, B. M.; Paine, R. T.; Raymond, K. N.; Moyer, B. A.; Jun. 15, 2004; 12 pp.; In English

Report No.(s): DE2005-838770; No Copyright; Avail: Department of Energy Information Bridge

Organic ligands that exhibit a high degree of metal ion recognition are essential precursors for developing separation processes and sensors for metal ions. Since the beginning of the nuclear era, much research has focused on discovering ligands that target specific radionuclides. Members of the Group 1A and 2A cations (e.g., Cs, Sr, Ra) and the f-block metals (actinides and lanthanides) are of primary concern to DOE. Although there has been some success in identifying ligand architectures that exhibit a degree of metal ion recognition, the ability to control binding affinity and selectivity remains a significant challenge. The traditional approach for discovering such ligands has involved lengthy programs of organic synthesis and testing that, in the absence of reliable methods for screening compounds before synthesis, have resulted in much wasted research effort. This project seeks to enhance and strengthen the traditional approach through computer-aided design of new and improved host molecules. Accurate electronic structure calculations are coupled with experimental data to provide fundamental information about ligand structure and the nature of metal-donor group interactions (design criteria). This fundamental information then is used in a molecular mechanics model (MM) that helps us rapidly screen proposed ligand architectures and select the best members from a set of potential candidates. By using combinatorial methods, molecule building software has been developed that generates large numbers of candidate architectures for a given set of donor groups. The specific goals of this project are: further understand the structural and energetic aspects of individual donor group- metal ion interactions and incorporate this information within the MM framework; further develop and evaluate approaches for correlating ligand structure with reactivity toward metal ions, in other words, screening capability; use molecule structure building software to generate large numbers of candidate ligand architectures for given sets of donor groups; and screen candidates and identify ligand architectures that will exhibit enhanced metal ion recognition. These new capabilities are being applied to ligand systems identified under other DOE-sponsored projects where studies have suggested that modifying existing architectures will lead to dramatic enhancements in metal ion binding affinity and selectivity.

NTIS

Computer Aided Design; Ligands; Metal Ions

20050200987 Kansas State Univ., Manhattan, KS USA

Characterization of New Materials for Photovoltaic Thin Films: Aggregation Phenomena in Self-Assembled Perylene-Based Diimides

Higgins, Daniel A.; Xie, Aifang; Liu, Bei; Jul. 2005; 23 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0584

Report No.(s): AD-A435695; No Copyright; Avail: CASI; [A03](#), Hardcopy

Under this grant, a new class of organic photovoltaic materials have been developed and characterized. These materials are comprised of cationic symmetrically- and asymmetrically-substituted perylene diimides and oppositely charged poly(acrylate) polyanions. Thin films of these materials yield photovoltages of ~ 140 mV for approximately 0.6 W/sq cm illumination intensities, when incorporated into rudimentary heterojunction devices. Solution phase fluorescence spectra obtained from the complexes exhibit excimer-like emission and evidence of weakly coupled ground-state aggregates. Small-angle X-ray diffraction indicates the films incorporate planar bilayers of the diimide and polyanion having 3.9 nm repeat distances. Scanning probe microscopy images show the films are heterogeneous, and are comprised of sub-micrometer sized clusters that incorporate the diimide. Polarization-dependent optical imaging studies prove the perylene chromophores are semi-organized in these clusters. Application of an electric field across the films induces a depth-dependent change in the fluorescence. This effect is attributed to reorientation of the perylene chromophores under the influence of the applied field.

DTIC

Organic Materials; Photovoltaic Effect; Thin Films

20050201036 Air Force Research Lab., Edwards AFB, CA USA

A Model for Ammonia Solar Thermal Thruster

Colonna, Gianpiero; Capitta, Giulia; Capitelli, Mario; Wysong, Ingrid; Kennedy, Fred; Apr. 2005; 12 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A435783; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper is an attempt to investigate the nozzle expansion of a solar thruster that uses ammonia as propellant. For this purpose we have developed a state to state kinetic model to study the dissociation of ammonia in supersonic nozzle expansion. The properties of the thruster depend on the ammonia dissociation degree in the reservoir, which can be very far from equilibrium due to the very slow dissociation kinetics at the thruster working conditions (~ 2000 K). We have extended the calculation for higher temperatures (~ 2500 K) where ammonia dissociation is higher. Due to the presence of some hydrogen atoms, non-Boltzmann distributions have been observed.

DTIC

Ammonia; Supersonic Nozzles

20050201053 Nanosonic, Inc., Blacksburg, VA USA

Temperature-Compensated Pressure-Sensitive Paint Containing a Bichromophoric Luminophore

Swavey, Rochael J.; Jun. 2005; 28 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0100

Report No.(s): AD-A435807; AFRL-SR-AR-TR-05-0262; No Copyright; Avail: CASI; [A03](#), Hardcopy

The effort that has been undertaken during this Phase I STTR program will enable NanoSonic and their academic partner at the University of Dayton to readily move toward commercialization of a sensor paint during Phase II. A bichromophoric compound containing a pressure-sensitive chromophore and a temperature-sensitive chromophore has been synthesized and formulated into a paint. The luminescent intensity response of the temperature sensor was characterized by fluorescence spectroscopy and was found to be linear in the specified temperature range. The luminescence intensity from the pressure sensor emission peak was found to be temperature independent. In addition, communications with Northrop Grumman during Phase I have lead to a partnership for independent testing of the sensor paint in a development wind tunnel.

DTIC

Chromophores; Fluorescence; Luminescence; Paints; Pressure Sensitive Paints; Temperature Sensitive Paints

20050201089 Mainstream Engineering Corp., Rockledge, FL USA

Advanced Testing of Safe-Solvent Replacements for CFC-113 for Use in Cleaning Oxygen Systems

Grzyll, Lawrence; Meyer, John; Back, Dwight; Jun. 2005; 24 pp.; In English

Contract(s)/Grant(s): F04611-01-C-0025; Proj-3005

Report No.(s): AD-A435887; No Copyright; Avail: Defense Technical Information Center (DTIC)

Use and Production of CFC-113 Restricted; - Replacement Cleaning Solvent Needed - Solvency As Good or Better Than CFC-113 Non-Flammable Compatible With Liquid and Gaseous Oxygen Low Toxicity or Non-Toxic Acceptable Environmental Properties Similar Volatility and Other Physical Properties Manufacturable at Reasonable Cost.

DTIC

Cleaning; Heat Exchangers; Oxygen; Oxygen Supply Equipment; Solvents; Toxicity; Volatility

20050201117 Army Air Forces, Wright-Patterson AFB, OH USA

Non-ODC Oxygen Line Cleaning for Use on DOD Weapons Systems

Ms. Mary, Hayes; Oct. 2003; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435973; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project successfully addressed both an environmental issue and a key technology issue related to military aerospace vehicles. Through this project, government and industry joined to develop a better way to clean the oxygen-supply systems of weapons systems by replacing ozone-depleting chemicals and a labor-intensive process with an environmentally safe, automated method that greatly improves upon past practices. The new technology developed as a result of this project improves the readiness of military aircraft, reduces costs, and dramatically reduces the crewmembers' chances of exposure to unhealthy toxins. Weapons systems have several types of oxygen-supply systems, all of which eventually develop contamination in the distribution systems as a result of opening the lines for maintenance. Contaminants and particulates within oxygen systems can pose significant hazards to both personnel and aerospace vehicles.

DTIC

Cleaning; Oxygen; Weapon Systems

20050201123 Delaware Univ., Newark, DE USA

Immobilized Filters for Air Filtration

Mahle, John J.; Zaiee, Saeed; Jan. 2002; 8 pp.; In English

Report No.(s): AD-A435989; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study will determine the feasibility of creating an immobilized bed of adsorbent particles using adhesives. The immobilized adsorbent will be designed for gas phase filtration in military respirators, in order to provide enhanced moldability (settling performance) and attrition resistance. The fabricated filter samples will be analyzed in order to determine the physical and chemical factors affecting mechanical strength and chemical filtration. Five different resin systems were studied in this work; epoxy/amine, vinyl-ester, water-borne epoxy/amine and two water-borne urethane pre-polymer. The first two resins are organic but epoxy/amine system is more hydrophilic than vinyl-ester. Samples were cured through temperature cycles appropriate for their corresponding resin. Optical microscopy was used to look at the samples and determine the extent of dispersion of resin with the activated carbon particles. Compressive and flexural properties of samples of activated carbon particles with water-borne resin systems were evaluated. This effort was focused on distinguishing between brittle failure and ductile failure of the samples.

DTIC

Air Filters; Filtration

20050201884 NASA Glenn Research Center, Cleveland, OH, USA

Novel Molecular Architectures Developed for Improved Solid Polymer Electrolytes for Lithium Polymer Batteries

Meador, Mary Ann B.; Kinder, James D.; Bennett, William R.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Lithium-based polymer batteries for aerospace applications need the ability to operate in temperatures ranging from -70 to 70 C. Current state-of-the-art solid polymer electrolytes (based on amorphous polyethylene oxide, PEO) have acceptable ionic conductivities (10⁻⁴ to 10⁻³ S/cm) only above 60 C. Higher conductivity can be achieved in the current systems by adding solvent or plasticizers to the solid polymer to improve ion transport. However, this can compromise the dimensional and thermal stability of the electrolyte, as well as compatibility with electrode materials. One of NASA Glenn Research Center's objectives in the PERS program is to develop new electrolytes having unique molecular architectures and/or novel ion transport mechanisms, leading to good ionic conductivity at room temperature and below without solvents or plasticizers. Derived from text

Amorphous Materials; Conductivity; Dimensional Stability; Electrode Materials; Lithium Batteries; Solid Electrolytes

20050201923 Oklahoma Univ., Norman, OK, USA

Origins of Deviations from Transition-State Theory:Formulating a New Kinetic Rate Law for Dissolution of Silicates. (Year 2, Progress Report)

London, D.; Jun. 2003; 12 pp.; In English

Report No.(s): DE2005-834828; No Copyright; Avail: Department of Energy Information Bridge

The task assigned to PI David London, University of Oklahoma, was to devise hydrothermal methods of synthesis that optimize the size of synthetic monocrystals of alkali feldspars, orthoclase, and albite. The synthesis method agreed upon will

utilize convention cold-seal hydrothermal reactors. This equipment and synthesis method were chosen for two reasons: (1) the method best simulates hydrothermal reactions of silicate glass waste material with groundwater, and (2) the method employs small, sealed volumes of reagents, which minimizes potential hazards when and if radionuclides are added to the system.

NTIS

Dissolving; Kinetics; Silicates

20050201925 Argonne National Lab., IL USA

Energy Technology Division Research Summary Addendum, 2004

Poeppel, R. B.; Shack, W. J.; Jun. 2004; 82 pp.; In English

Report No.(s): DE2005-834709; No Copyright; Avail: Department of Energy Information Bridge

This document provides materials and engineering technology support to a wide range of programs important to the Department of Energy. The division's capabilities are applied to technical issues associated with energy systems, computational physics, hydrodynamics, electromechanics, sensors, instrumentation, nondestructive evaluation, hazardous materials, tribology, and irradiation.

NTIS

Energy Technology; Quality Control; Reactor Safety

20050201947 Texas Univ., Austin, TX, USA

Comparison of Hot Rubber Crack Sealants to Emulsified Asphalt Crack Sealants (First Report of a Three-Year Study)

Yildirim, Y.; Solaimanian, M.; Kennedy, T. W.; Aug. 2004; 130 pp.; In English

Report No.(s): PB2005-108901; RR-0-4061-1; No Copyright; Avail: CASI; [A07](#), Hardcopy

This is the first report from Center for Transportation Research on the Project 4061. It presents the results, findings, conclusions, and recommendations based on the surveys, lab tests, and information collected on test sections for the first year of a 3 year study. Sealing and filling cracks has always been an important consideration in pavement maintenance. Hot rubber asphalt has been the most commonly used material for this purpose providing good performance in most cases. However, safety has been an issue with the use of hot rubber asphalt crack sealants because they must be applied at approximately 350 deg F - 400 deg F. In addition, vehicle tires can easily pick up material if sufficient adherence is not developed between the sealant and the crack sides. Some Texas Department of Transportation districts have been using cold pour asphalt emulsion crack sealants to address the safety problem. However, cold pour crack sealant requires longer setting and curing time, especially in areas of high humidity. In addition, the performance history of these cold sealants is not known or not well documented in comparison to the performance of hot pour crack sealants. Furthermore, the cost associated with the use of this material versus hot pour rubber asphalt is not well documented or determined. This research project is intended to compare the cost-effectiveness, ease and safety of installation, performance, and life-cycle cost for hot rubber asphalt crack sealant, cold pour asphalt emulsion crack sealant, and cold pour asphalt emulsion joint sealant. The comparison includes seven different crack and joint sealants: three cold pour and four hot pour. Eight different roads in five districts were selected for comparison of sealants. A total of thirty-three different test sections were obtained through this operation. Ease and speed of construction, as well as the original sealing cost were compared for these sealants. The crack-sealed sections in all five districts were visited approximately 3 months after construction. It is observed that the sealants show relatively good performance. However, in some of the test sections, some loss of cold pour sealants was noticed.

NTIS

Asphalt; Cracks; Pavements; Rubber; Sealers; Sealing

20050201967 Lawrence Livermore National Lab., Livermore, CA USA

Boundary Conditions for Dislocation Dynamics Simulations and Stage 0 of BBC Metals at Low Temperature

Tang, M.; Kubin, L. P.; January 2005; 12 pp.; In English

Report No.(s): DE2005-15013313; UCRL-JC-143692; No Copyright; Avail: Department of Energy Information Bridge

In order to study the dislocation density evolution of body centered cubic (bcc) crystals at low temperature by dislocation dynamics (DD) simulations, we investigated carefully three different boundary conditions (BC) for DD, i.e., the quasi-free surface BC, the flux-balanced BC, and the periodic BC. The latter two BCs can account for the dislocation loss from the boundary of the finite simulation box. PBC can also eliminate the influence of surfaces and improve the line connectivity. We have found that the PBC provides a convenient and effective boundary condition for DD simulations and have applied it to

the study of dislocation density evolution of bcc metals during stage 0 deformation at low temperature.

NTIS

Body Centered Cubic Lattices; Boundary Conditions; Dislocations (Materials); Low Temperature; Metals; Simulation

20050201987 Department of Energy, Washington, DC, USA

Materials Selection Considerations for Thermal Process Equipment: A BestPractices Process Heating Technical Brief

January 2005; 12 pp.; In English

Report No.(s): DE2005-15011683; No Copyright; Avail: Department of Energy Information Bridge

This technical brief is a guide to selecting high-temperature metallic materials for use in process heating applications such as burners, electrical heating elements, material handling, load support, and heater tubes, etc.

NTIS

Heating; Materials Selection; Refractory Materials

20050202001 Lawrence Livermore National Lab., Livermore, CA USA

Chemistry and Materials Science Directorate 2002 Postdoctoral Symposium

Wirth, B. D.; Aug. 14, 2002; 44 pp.; In English

Report No.(s): DE2005-15013464; UCRL-JC-149661; No Copyright; Avail: Department of Energy Information Bridge

This document presents the chemistry and materials science directorate 2002 postdoctoral symposium.

NTIS

Chemistry; Materials Science

20050203730 Swales Aerospace, Beltsville, MD, USA

QCM Thermo-Gravimetric Analysis (QTGA) Comparisons

Rosecrans, Glenn; Meadows, George; 23rd Space Simulation Conference Proceedings; [2005]; 29 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ASTM E-1559 apparatus has been used for years at NASA/Goddard Space Flight Center (GSFC) to determine in situ outgassing rate information, as well as pertinent in situ TML and multiple VCM values. The apparatus also affords the opportunity to experimentally compute the evaporation rates of molecular species that are reemitted as the Quartz Crystal Microbalances (QCMs) are gradually warmed up at some controlled temperature. Typically the molecular mass that accumulates onto the test QCMs are a compilation of species that are outgassing from the sample due to their respective activation energies and the desorption processes that the sample undergoes at various tested temperatures. It has been speculated that if there is too much molecular buildup of condensed water vapor (ice) onto the QCM crystal that a significantly higher temperature would be needed to break these 'ice' bonds. ASTM E-1559 data plots will be used to demonstrate the thermogravimetric effects of water and other miscible molecular species with various water/ice thicknesses and at different evaporation rates.

Author

Thermogravimetry; In Situ Measurement; Outgassing; Gas Analysis; Microbalances

20050203752 NASA Glenn Research Center, Cleveland, OH, USA

Microscale Concentration Measurements Using Laser Light Scattering Methods

Niederhaus, Charles; Miller, Fletcher; [2004]; 1 pp.; In English; Great Lakes Photonics Symposium, 7-11 Jun. 2004, Cleveland, OH, USA

Contract(s)/Grant(s): IR&D-2201-SR-0052; No Copyright; Avail: Other Sources; Abstract Only

The development of lab-on-a-chip devices for microscale biochemical assays has led to the need for microscale concentration measurements of specific analyses. While fluorescence methods are the current choice, this method requires developing fluorophore-tagged conjugates for each analyte of interest. In addition, fluorescent imaging is also a volume-based method, and can be limiting as smaller detection regions are required.

Author

Light Scattering; Laser Applications; Bioassay; Concentration (Composition)

COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20050199717 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Oxide Material Systems For 1650 C Thermal/Environmental Barrier Coating Applications

Zhu, Dongming; Fox, Dennis S.; Bansal, Narottam P.; Miller, Robert A.; [2004]; 13 pp.; In English; Fifth International Conference on High Temperature Ceramic Matrix Composites, 12-16 Sep. 2004, Seattle, WA, USA; No Copyright; Avail: CASI; [A03](#), Hardcopy

Advanced thermal/environmental barrier coatings (T/EBCs) are being developed for low emission SiC/SiC ceramic matrix composite (CMC) combustor and vane applications to extend the CMC liner and vane temperature capability to 1650 C (3000 F) in oxidizing and water-vapor containing combustion environments. The 1650 C T/EBC system is required to have better thermal stability, lower thermal conductivity, and improved sintering and thermal stress resistance than current coating systems. In this paper, the thermal conductivity, water vapor stability and cyclic durability of selected candidate zirconia-hafnia-, pyrochlore- and magnetoplumbite-based T/EBC materials are evaluated. The test results have been used to downselect the T/EBC coating materials, and help demonstrate advanced 1650OC coatings feasibility with long-term cyclic durability.

Author

Ceramic Matrix Composites; Oxides; Protective Coatings; Thermal Control Coatings

20050199732 NASA Glenn Research Center, Cleveland, OH, USA

New High-Performance SiC Fiber Developed for Ceramic Composites

DiCarlo, James A.; Yun, Hee Mann; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Sylramic-iBN fiber is a new type of small-diameter (10-mm) SiC fiber that was developed at the NASA Glenn Research Center and was recently given an R&D 100 Award for 2001. It is produced by subjecting commercially available Sylramic (Dow Corning, Midland, MI) SiC fibers, fabrics, or preforms to a specially designed high-temperature treatment in a controlled nitrogen environment for a specific time. It can be used in a variety of applications, but it currently has the greatest advantage as a reinforcement for SiC/SiC ceramic composites that are targeted for long-term structural applications at temperatures higher than the capability of metallic superalloys. The commercial Sylramic SiC fiber, which is the precursor for the Sylramic-iBN fiber, is produced by Dow Corning, Midland, Michigan. It is derived from polymers at low temperatures and then pyrolyzed and sintered at high temperatures using boron-containing sintering aids (ref. 1). The sintering process results in very strong fibers (~ 3 GPa) that are dense, oxygen-free, and nearly stoichiometric. They also display an optimum grain size that is beneficial for high tensile strength, good creep resistance, and good thermal conductivity (ref. 2). The NASA-developed treatment allows the excess boron in the bulk to diffuse to the fiber surface where it reacts with nitrogen to form an in situ boron nitride (BN) coating on the fiber surface (thus the product name of Sylramic-iBN fiber). The removal of boron from the fiber bulk allows the retention of high tensile strength while significantly improving creep resistance and electrical conductivity, and probably thermal conductivity since the grains are slightly larger and the grain boundaries cleaner (ref. 2). Also, as shown in the graph, these improvements allow the fiber to display the best rupture strength at high temperatures in air for any available SiC fiber. In addition, for CMC applications under oxidizing conditions, the formation of an in situ BN surface layer creates a more environmentally durable fiber surface not only because a more oxidation-resistant BN is formed, but also because this layer provides a physical barrier between contacting fibers with oxidation-prone SiC surface layers (refs. 3 and 4). This year, Glenn demonstrated that the in situ BN treatment can be applied simply to Sylramic fibers located within continuous multifiber tows, within woven fabric pieces, or even assembled into complex product shapes (preforms). SiC/SiC ceramic composite panels have been fabricated from Sylramic-iBN fabric and then tested at Glenn within the Ultra-Efficient Engine Technology Program. The test conditions were selected to simulate those experienced by hot-section components in advanced gas turbine engines. The results from testing at Glenn demonstrate all the benefits expected for the Sylramic-iBN fibers. That is, the composites displayed the best thermostructural performance in comparison to composites reinforced by Sylramic fibers and by all other currently available high-performance SiC fiber types (refs. 3 and 5). For these reasons, the Ultra-Efficient Engine Technology Program has selected the Sylramic-iBN fiber for ongoing efforts aimed at SiC/SiC engine component development.

Author

Silicon Carbides; Ceramic Matrix Composites; Composite Structures; Boron Nitrides; Boron Fibers; High Temperature; High Strength; Heat Resistant Alloys

20050199754 NASA Glenn Research Center, Cleveland, OH, USA

Strength and Fracture Toughness of Solid Oxide Fuel Cell Electrolyte Material Improved

Bansal, Narottam P.; Choi, Sung R.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Solid oxide fuel cells (SOFC) are being developed for various applications in the automobile, power-generation, and aeronautics industries. Recently, the NASA Glenn Research Center has been exploring the possibility of using SOFC's for aeropropulsion under its Zero Carbon Dioxide Emission Technology (ZCET) Program. 10-mol% yttrium-stabilized zirconia (10YSZ) is a very good anionic conductor at high temperatures and is, therefore, used as an oxygen solid electrolyte in SOFC. However, it has a high thermal expansion coefficient, low thermal shock resistance, low fracture toughness, and poor mechanical strength. For aeronautic applications, the thin ceramic electrolyte membrane of the SOFC needs to be strong and tough. Therefore, we have been investigating the possibility of enhancing the strength and fracture toughness of the 10YSZ electrolyte without degrading its electrical conductivity to an appreciable extent. We recently demonstrated that the addition of alumina to zirconia electrolyte increases its strength as well as its fracture toughness. Zirconia-alumina composites containing 0 to 30 mol% of alumina were fabricated by hot pressing. The hot pressing procedure was developed and various hot pressing parameters were optimized, resulting in dense, crack-free panels of composite materials. Cubic zirconia and α -alumina were the only phases detected, indicating that there was no chemical reaction between the constituents during hot pressing at elevated temperatures. Flexure strength and fracture toughness (K_{IC}) of the various zirconia-alumina composites were measured at room temperature as well as at 1000 C in air. Both properties showed systematic improvement with increased alumina addition at room temperature and at 1000 C. Use of these modified electrolytes with improved strength and fracture toughness should prolong the life and enhance the performance of SOFC in aeronautics and other applications.

Author

Electrolytes; Fracture Strength; Solid Oxide Fuel Cells; Toughness; Mechanical Properties; Fabrication; Composite Materials

20050199755 NASA Glenn Research Center, Cleveland, OH, USA, Case Western Reserve Univ., Cleveland, OH, USA

Ceramic Propellant Injectors Designed and Fabricated

Eckel, Andrew J.; Research and Technology 2001; March 2002; 1 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Ceramic propellant injectors offer the potential for order-of-magnitude weight reductions in comparison to conventional metallic injectors and may enable some NASA missions. Injectors constructed of ceramic materials have the inherent advantages of being lighter weight, more erosion resistant, and capable of higher temperature operation than current metallic designs. The use of ceramics may facilitate new designs for a broad range of combustion devices in aero and space applications. In a joint project involving NASA Glenn Research Center's Ceramics and Combustion branches and Case Western Reserve University, a rocket propellant injector faceplate was designed and fabricated using laminated object manufacturing and standard ceramic processing. A number of faceplates have been successfully hot-fire bench tested.

Author

Injectors; Ceramics; Rocket Propellants; Weight Reduction

20050199756 NASA Glenn Research Center, Cleveland, OH, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Lightweight, Actively Cooled Ceramic Matrix Composite Thrustcells Successfully Tested in Rocket Combustion Lab

Jaskowiak, Martha H.; Elam, Sandra K.; Effinger, Michael R.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

In a joint effort between the NASA Glenn Research Center and the NASA Marshall Space Flight Center, regeneratively cooled ceramic matrix composite (CMC) thrustcells were developed and successfully tested in Glenn's Rocket Combustion Lab. Cooled CMC's offer the potential for substantial weight savings over more traditional metallic parts. Two CMC concepts were investigated. In the first of these concepts, an innovative processing approach utilized by Hyper-Therm, Inc., allowed woven CMC coolant containment tubes to be incorporated into the complex thruster design. In this unique design, the coolant passages had varying cross-sectional shapes but maintained a constant cross-sectional area along the length of the thruster. These thrusters were silicon carbide matrix composites reinforced with silicon carbide fibers. The second concept, which was supplied by Ceramic Composites, Inc., utilized copper cooling coils surrounding a carbon-fiber-reinforced carbon matrix composite. In this design, a protective gradient coating was applied to the inner thruster wall. Ceramic Composites, Inc.'s, method of incorporating the coating into the fiber and matrix eliminated the spallation problem often observed with thermal barrier coatings during hotfire testing. The focus of the testing effort was on screening the CMC material's capabilities as well as evaluating the performance of the thermal barrier or fiber-matrix interfacial coatings. Both concepts were hot-fire tested in

gaseous O₂/H₂ environments. The test matrix included oxygen-to-fuel ratios ranging from 1.5 to 7 with chamber pressures to 400 psi. Steady-state internal wall temperatures in excess of 4300 F were measured in situ for successful 30-sec test runs. Photograph of actively cooled composite thrustcell fabricated by Hyper-Therm is shown. The thrustcell is a silicon-carbide-fiber-reinforced silicon carbide matrix composite with woven cooling channels. The matrix is formed via chemical vapor infiltration. Photograph of hot-fire test of an actively cooled carbon-fiber-reinforced carbon matrix composite thrustcell is also shown. This composite thrustcell, which was fabricated by CCI, Inc., was wound with copper cooling coils to contain the water coolant. The tests were run with oxygen fuel ratios up to seven with chamber pressures of 200 psia.

Author

Ceramic Matrix Composites; Combustion; Fabrication; Thrust; Regenerative Cooling; Rocket Engines

20050201662 Iowa State Univ. of Science and Technology, Ames, IA USA

Design of Bio-Hybrid Surface Assemblies at Engineering Interfaces

Tsukruk, Vladimir V.; May 2005; 11 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0205

Report No.(s): AD-A435743; AFRL-SR-AR-TR-05-0291; No Copyright; Avail: CASI; [A03](#), Hardcopy

The project is devoted to designing and fabricating flexible free-suspended nanocomposite membranes based on a bioinspired concept of snake photothermal receptors. We suggested an innovative fabrication technique which can be used to obtain robust and lightweight, microscopic nanocomposite membranes with extraordinary sensitivity and dynamic range. These nanomembranes with thickness of 30-50 nm and diameter of several hundred microns, which can be free-suspended over a microscopic opening were fabricated with molecular precision by time-efficient, spin-assisted layer-by-layer assembly on a sacrificial substrate. They are designed as multilayered nanocomposite films composed of polymer bilayers alternating in ordered fashion and gold nanoparticles with a diameter below 13 nm and possess unparalleled sensitivity combined with extreme robustness.

DTIC

Nanocomposites; Nanofabrication

20050201794 NASA Glenn Research Center, Cleveland, OH, USA

Polymer/Silicate Nanocomposites Developed for Improved Thermal Stability and Barrier Properties

Campbell, Sandi G.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The nanoscale reinforcement of polymers is becoming an attractive means of improving the properties and stability of polymers. Polymer-silicate nanocomposites are a relatively new class of materials with phase dimensions typically on the order of a few nanometers. Because of their nanometer-size features, nanocomposites possess unique properties typically not shared by more conventional composites. Polymer-layered silicate nanocomposites can attain a certain degree of stiffness, strength, and barrier properties with far less ceramic content than comparable glass- or mineral-reinforced polymers. Reinforcement of existing and new polyimides by this method offers an opportunity to greatly improve existing polymer properties without altering current synthetic or processing procedures.

Author

Nanocomposites; Thermal Stability; Silicates; Polymer Matrix Composites; Polyimides

20050201883 NASA Glenn Research Center, Cleveland, OH, USA

NASA Glenn/AADC Collaboration Optimized Erosion Coatings for Inlet Guide Vanes

Sutter, James K.; Leissler, George; Horan, Richard; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

There is a need for lightweight, durable materials and structures to reduce the weight of propulsion systems. Polymer matrix composites (PMC's) are promising materials for aerospace applications because of their high strength-to-weight ratio relative to metals. Unfortunately, they are limited to applications where they are not exposed to hightemperature oxidizing atmospheres and/or particulates from ingested air. This is because oxidation and erosion occur on the surface, leading to weight loss, nodulation, and/or cracking on the surface, and a consequent decline of mechanical properties over time. Although prior research has shown that oxidation can be slowed when metallic or ceramic coatings are applied onto PMC's, there remains a need for erosion-resistant coatings that protect PMC's from high-velocity particulates in the engine flow path. These erosion-resistant coatings could extend the life of polymer composites. Polymer composites are heavily damaged without an erosion-resistant coating because they are not as hard as metallic engine structures. The effectiveness and life of the coatings

depends on their inherent properties as well as on the interaction between the coating and the PMC. Since polymers, in general, have high thermal expansion coefficients in comparison to metals and ceramics, failure of the coatings often occurs at this interface. The objective of this research is to develop strategies to improve this interface and tailor overlays for erosion resistance. The bondcoat, which was developed at the NASA Glenn Research Center, is composed of zinc blended with polyimides to improve the compatibility between the PMC and the overlay material. Initial coating trials at AADC produced vanes that had poor bonding between the overlay and bondcoats. Subsequently, Glenn successfully demonstrated that high-quality plasma-sprayed erosion coating systems could be applied to these guide vanes. Inlet guide vanes from AE 3007 engines fiber composites were coated using a coating system composed of a bondcoat and a hard topcoat. Optimization of the plasma spray process has led to plans for future erosion testing in gas turbine engine environments.

Derived from text

Erosion; Guide Vanes; Optimization; Coatings; Engine Inlets; Mechanical Properties; NASA Programs

20050201896 NASA Glenn Research Center, Cleveland, OH, USA

Architectures for High-Performance Ceramic Composites Being Improved

Yun, Hee Mann; DiCarlo, James A.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A major thrust of the Ultra-Efficient Engine Technology (UEET) Program at the NASA Glenn Research Center is to develop advanced hot-section engine components using SiC/SiC ceramic matrix composites (CMC's) with thermostructural capability to 2400 F (1315 C). In previous studies, UEET determined that the higher the ultimate tensile strength (UTS) of the as-fabricated CMC, the greater its structural performance at 2400 F. Thus efforts have been ongoing within UEET to understand and develop fiber architecture approaches that can improve the UTS of SiC/SiC CMC's. Under UEET, SiC/SiC test panels and demonstration engine components are currently produced by the multi-ply layup of two-dimensional fabric pieces. The fabric is typically formed of multifilament tows containing high-performance Sylramic (Dow Corning) SiC fiber that is woven into two-dimensional five-harness satin fabric with 20 ends per inch in the 0 degree and 90 degree directions. In some cases, fabric pieces containing woven Sylramic fiber tows are thermally treated at NASA to form Sylramic-iBN fibers that contain a very thin in-situ-grown boron nitride layer on their surfaces. The final SiC/SiC panels and components are fabricated at the CMC vendor by compressing the fabric pieces in tools and then depositing a thin BN interphase coating on the fibers by chemical vapor deposition. The last step at the vendor is to infiltrate the BN-coated fiber architecture with SiC and silicon matrix constituents to form a dense product. Because the as-produced Sylramic fiber tows are sized with a thin polymer coating to facilitate handling and weaving, the individual fibers within the tows and fabric are in close contact with each other. This contact is further increased during fabric compression. One important recent finding is that increasing Sylramic fiber tow width in a fabric increases the UTS of the final SiC/SiC CMC. This effect is presumably related to minimizing fiber/fiber contact, which can be detrimental to CMC strength because of the boron-rich chemistry and roughness of the Sylramic fiber surface. Tows can be spread by mechanically agitating the Sylramic fabric prior to CMC fabrication or by simply thermally treating the Sylramic fabric as in the formation of the Sylramic-iBN fibers. However, CMC's with the treated Sylramic-iBN fabric are even stronger than CMC's with mechanically spread Sylramic tows. The extra strength capability is presumably related to the in situ BN on the fiber surface, which adds compliance to the fiber surfaces and is more resistant to oxygen impurities introduced during the chemical vapor deposition BN process. As shown, another important finding is that the use of fabric with tows having less than the standard of 20 ends per inch provides advantages in terms of reduced ply height and increased ply and CMC strength. The reduced ply height provides more control of part thickness by allowing more plies for a given thickness and by reducing interlaminar residual stresses between plies. The increased ply strength is presumably related to a reduced number of interlaced 90 tows, which, in turn, reduces the crimp angle on the high-modulus fibers in the 0 degree tows. Also, as shown, although fabric with fewer ends per inch reduced the maximum fiber fraction in an eight-ply CMC panel; CMC UTS actually increased because of increased ply strength. Thus, using fabric with fewer ends per inch has several advantages, including providing a significantly higher strength per fiber fraction in the CMC. Consequently, ongoing UEET efforts will attempt to use architectural approaches for components that minimize fiber-fiber contacts and fiber bending within the final composite microstructure.

Derived from text

Ceramic Matrix Composites; Fabrication; Silicon Carbides; Microstructure; Reinforcing Fibers

20050201897 NASA Glenn Research Center, Cleveland, OH, USA

Ceramic Composite Intermediate Temperature Stress-Rupture Properties Improved Significantly

Morscher, Gregory N.; Hurst, Janet B.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Silicon carbide (SiC) composites are considered to be potential materials for future aircraft engine parts such as combustor liners. It is envisioned that on the hot side (inner surface) of the combustor liner, composites will have to withstand temperatures in excess of 1200 C for thousands of hours in oxidizing environments. This is a severe condition; however, an equally severe, if not more detrimental, condition exists on the cold side (outer surface) of the combustor liner. Here, the temperatures are expected to be on the order of 800 to 1000 C under high tensile stress because of thermal gradients and attachment of the combustor liner to the engine frame (the hot side will be under compressive stress, a less severe stress-state for ceramics). Since these composites are not oxides, they oxidize. The worst form of oxidation for strength reduction occurs at these intermediate temperatures, where the boron nitride (BN) interphase oxidizes first, which causes the formation of a glass layer that strongly bonds the fibers to the matrix. When the fibers strongly bond to the matrix or to one another, the composite loses toughness and strength and becomes brittle. To increase the intermediate temperature stress-rupture properties, researchers must modify the BN interphase. With the support of the Ultra-Efficient Engine Technology (UEET) Program, significant improvements were made as state-of-the-art SiC/SiC composites were developed during the Enabling Propulsion Materials (EPM) program. Three approaches were found to improve the intermediate-temperature stress-rupture properties: fiber-spreading, high-temperature silicon- (Si) doped boron nitride (BN), and outside-debonding BN.

Author

Silicon Carbides; Ceramic Matrix Composites; Boron Nitrides; Woven Composites

20050201906 NASA Glenn Research Center, Cleveland, OH, USA

High-Temperature Intercalated Graphite Fiber Conductors Fabricated

Gaier, James R.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Composites of intercalated graphite fibers show promise to significantly reduce the weight of electromagnetic interference shielding in spacecraft and aircraft. Bromine intercalated pitch-based fibers have been among the most heavily studied systems because of their attractive electrical and thermal conductivities and their stability over a wide range of environmental conditions. Previous studies found that the resistivity of bromine-intercalated graphite fibers began to increase when the fibers were exposed to temperatures in excess of about 200 C in air for long periods of time. If the temperature was as high as 450 C, the resistivity increased dramatically within a few hours. It remained unclear, however, whether the increase was due to deintercalation of the bromine or to air oxidation of the fibers. Studies were initially directed toward determining the temperature at which bromine would deintercalate from the fibers, and perhaps become a hazard to both personnel and equipment. So the mass of bromine-intercalated graphite fibers was carefully monitored as it was heated in an inert atmosphere, since the fibers are known to oxidize at a lower temperature than they deintercalate. What was found was that the fibers, which are about 18-wt% bromine, did not lose any appreciable mass even at temperatures approaching 1000 C. X-ray diffraction studies showed that there were also no changes in the overall structure of the compound. Resistivity measurements indicated that there is some slight degradation in the electronic structure, in that the resistivity increased by a few percent. Overall, the results show that these materials may be suitable for applications at temperatures at least this high, provided oxygen is excluded. This may enable their use in carbon-ceramic, and perhaps even carbon-carbon composites.

Author

Conductors; Fabrication; High Temperature; Graphite; Fiber Composites

20050201907 NASA Glenn Research Center, Cleveland, OH, USA

Solar Selective Coatings Developed for Space Power Applications

Jaworske, Donald A.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A solar collector having the combined properties of high solar absorptance, low infrared emittance, and high thermal conductivity is envisioned for space power applications on minisatellites. A high solar absorptance is needed to collect as much of the incident solar radiation as possible and a low infrared emittance is needed to minimize radiant energy losses. A lightweight material having a high thermal conductivity is needed to transport the absorbed energy to where it is needed. Such a solar collector may be used with a low temperature-differential heat engine to provide electric power to the minisatellite components or as a source of thermal energy for a thermal bus that would heat remote regions of the spacecraft. The key to such a collector is the use of cermet coatings. Cermet coatings are composed of molecular islands of metal embedded in a three-dimensional matrix of dielectric. Recent research on molecular mixtures of aluminum and aluminum oxide at the NASA Glenn Research Center has yielded cermet coatings with a solar absorptance α of 0.797 and an infrared emittance ϵ of 0.131, yielding an α/ϵ ratio of 6. Although additional work is needed to further increase the α/ϵ ratio, these coatings are attractive owing to their potential durability in the space environment. The aluminum oxide surface should provide substantial protection from the atomic oxygen found in low Earth orbit. To help minimize emittance, these coatings

are deposited on a smooth surface. The selected surface is aluminum that has been diamond turned to a mirror finish. Cermet coatings are manufactured by sputter deposition. To achieve the desired variable composition, Glenn's researchers implemented a novel approach using a cylindrical target composed of aluminum and aluminum oxide. Rotating the cylinder during the deposition process yields a coating of variable composition. A photograph of the custom-made aluminum and aluminum oxide cylindrical target installed in the sputter deposition chamber is shown.

Author

Coating; Solar Collectors; Spacecraft Propulsion; Cermets

20050201909 NASA Glenn Research Center, Cleveland, OH, USA

Knowledge of Pest Resistance in SiC/BN/SiC Composites Improved

Thomas-Ogbuji, Linus U.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Ceramic-matrix composites (CMC's) consisting of a silicon carbide matrix reinforced with boron-nitride- (BN-) coated silicon carbide (SiC) fibers are strong contenders for commercial and aerospace applications (in particular, the hot sections of high-performance turbine engines in advanced aircraft and generators). They have very good mechanical properties below approximately 600 C and above approximately 1000 C. Between those temperatures, however, the BN coating oxidizes easily, and the oxidation of the SiC matrix is too sluggish to seal off the composite with a protective layer of silica. In that temperature interval, the preferential oxidation of the BN weakens and embrittles the composite. That phenomenon, referred to as 'pest' degradation, is the focus of this work, which aims to identify the causes of and remedies for pesting. Previous work established that pesting in Hi-Nicalon (Nippon Carbon Co., Ltd., Japan)/SiC composites was caused by a layer of free carbon that undermined the oxidation resistance of the BN. New work suggests that composites containing a source of carbon are prone to severe pesting and that those that are free of elemental carbon are resistant to pesting. Pest resistance was assessed by exposing machined samples for 100 to 150 hr in an atmospheric burner rig at 600 to 1100 C, followed by a tensile fracture test to measure residual mechanical properties and by characterization of the interphase microstructure. Whether the elemental carbon came from intrinsic or extrinsic sources, its presence induced the tensile strength to drop by over 50 percent in the burner rig, with an even more severe loss of fracture strain. A likely mechanism by which burnoff of the carbon layer exposes the BN to accelerated flank attack by ambient oxidants is shown. The BN is replaced with borosilicates that attack the fiber, and ultimately with silica that embrittles the composites by rigidly bonding components. Thus, the study has shown that pesting can be prevented in SiC/BN/SiC, or at least reduced, by simply excluding free carbon. These studies continue, and plans for future work include investigating the role that carbon may play elsewhere in the interphase region.

Author

Boron Nitrides; Ceramic Matrix Composites; Silicon Carbides; Mechanical Properties; Oxidation Resistance

20050202020 Michigan Technological Univ., Houghton, MI, USA

Studies of Carbon Nanotubes

Caneba, Gerard T.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 3-1 - 3-15; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

The fellowship experience for this summer for 2004 pertains to carbon nanotube coatings for various space-related applications. They involve the following projects: (a) EMI protection films from HiPco-polymers, and (b) Thermal protection nanosilica materials. EMI protection films are targeted to be eventually applied onto casings of laptop computers. These coatings are composites of electrically-conductive SWNTs and compatible polymers. The substrate polymer will be polycarbonate, since computer housings are typically made of carbon composites of this type of polymer. A new experimental copolymer was used last year to generate electrically-conductive and thermal films with HiPco at 50/50 wt/wt composition. This will be one of the possible formulations. Reference films will be base polycarbonate and neat HiPco onto polycarbonate films. Other coating materials that will be tried will be based on HiPco composites with commercial enamels (polyurethane, acrylic, polyester), which could be compatible with the polycarbonate substrate. Nanosilica fibers are planned for possible use as thermal protection tiles on the shuttle orbiter. Right now, microscale silica is used. Going to the nanoscale will increase the surface-volume-per-unit-area of radiative heat dissipation. Nanoscale carbon fibers/nanotubes can be used as templates for the generation of nanosilica. A sol-gel operation is employed for this purpose.

Author

Nanotubes; Carbon Nanotubes; Carbon Fibers; Thermal Protection; Copolymers; Polycarbonates; Polyurethane Resins

20050202023 LeTourneau Univ., Longview, TX, USA

Diagnostics of Carbon Nanotube Formation in a Laser Produced Plume: Spectroscopic in situ nanotube detection using spectral absorption and surface temperature measurements by black body emission

DeBoer, Gary D.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 5-1 - 5-14; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; No Copyright; Avail: CASI; A03, Hardcopy

Carbon nanotubes hold great promise for material advancements in the areas of composites and electronics. The advancement of research in these areas is dependent upon the availability of carbon nanotubes to a broad spectrum of academic and industrial researchers. Although there has been much progress made in reducing the costs of carbon nanotubes and increasing the quality and purity of the products, an increase in demand for still less expensive and specific nanotubes types has also grown. This summer's work has involved two experiments that have been designed to further the understanding of the dynamics and chemical mechanisms of carbon nanotube formation. It is expected that a better understanding of the process of formation of nanotubes will aid current production designs and stimulate ideas for future production designs increasing the quantity, quality, and production control of carbon nanotubes. The first experiment involved the measurement of surface temperature of the target as a function of time with respect to the ablation lasers. A peak surface temperature of 5000 K was determined from spectral analysis of black body emission from the target surface. The surface temperature as a function of various changes in operating parameters was also obtained. This data is expected to aid the modeling of ablation and plume dynamics. The second experiment involved a time and spatial measurement of the spectrally resolved absorbance of the laser produced plume. This experiment explored the possibility of developing absorbance and fluorescence to detect carbon nanotubes during production. To attain control over the production of nanotubes with specific properties and reduce costs, a real time in situ diagnostics method would be very beneficial. Results from this summer's work indicate that detection of nanotubes during production may possibly be used for production feed back control.

Author

Carbon Nanotubes; Surface Temperature; Time Dependence; Ablation; Lasers; Plumes; Time Measurement; Spectrum Analysis; Black Body Radiation

20050202089 NASA Glenn Research Center, Cleveland, OH, USA

Damage Accumulation and Failure of Plasma-Sprayed Thermal Barrier Coatings under Thermal Gradient Cyclic Conditions

Zhu, Dongming; Choi, Sung R.; Ghosn, Louis J.; Miller, rober A.; [2005]; 1 pp.; In English; Symposium on Advanced Ceramic Coatings for Structural, Environmental and Functional Applications, 23-28 Jan. 2005, Cocoa Beach, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Thermal barrier coatings will be more aggressively designed to protect gas turbine engine hot-section components in order to meet future engine higher fuel efficiency and lower emission goals. A fundamental understanding of the sintering and thermal cycling induced delamination of thermal barrier coating systems under engine-like heat flux conditions will potentially help to improve the coating temperature capability. In this study, a test approach is established to emphasize the real-time monitoring and assessment of the coating thermal conductivity, which can initially increase under the steady-state high temperature thermal gradient test due to coating sintering, and later decrease under the thermal gradient cyclic test due to coating cracking and delamination. Thermal conductivity prediction models have been established for a ZrO_2 -(7-8wt%) Y_2O_3 model coating system in terms of heat flux, time, and testing temperatures. The coating delamination accumulation is then assessed based on the observed thermal conductivity response under the combined steady-state and cyclic thermal gradient tests. The coating thermal gradient cycling associated delaminations and failure mechanisms under simulated engine heat-flux conditions will be discussed in conjunction with the coating sintering and fracture testing results.

Author

Damage; Plasma Spraying; Temperature Gradients; Thermal Control Coatings; Failure Analysis

20050203650 QSS Group, Inc., Cleveland, OH, USA

Implementation Challenges for Ceramic Matrix Composites in High Temperature Applications

Singh, Mrityunjay; [2004]; 1 pp.; In English; International Conference on Recent Advances in Composite Materials (ICRACM-2004), 17-19 Dec. 2004, Varanasi, India

Contract(s)/Grant(s): NAS3-00145; No Copyright; Avail: Other Sources; Abstract Only

Ceramic matrix composites are leading candidate materials for a number of applications in aeronautics, space, energy, electronics, nuclear, and transportation industries. In the aeronautics and space exploration systems, these materials are being considered for applications in hot sections of jet engines such as the combustor liner, nozzle components, nose cones, leading

edges of reentry vehicles and space propulsion components. Applications in the energy and environmental industries include radiant heater tubes, heat exchangers, heat recuperators, gas and diesel particulate filters (DPFs), and components for land based turbines for power generation. These materials are also being considered for use in the first wall and blanket components of fusion reactors. There are a number of critical issues and challenges related to successful implementation of composite materials. Fabrication of net and complex shape components with high density and tailorable matrix properties is quite expensive, and even then various desirable properties are not achievable. In this presentation, microstructure and thermomechanical properties of composites fabricated by two techniques (chemical vapor infiltration and melt infiltration), will be presented. In addition, critical need for robust joining and assembly technologies in successful implementation of these systems will be discussed. Other implementation issues will be discussed along with advantages and benefits of using these materials for various components in high temperature applications.

Author

Ceramic Matrix Composites; Refractory Materials

20050203664 NASA Glenn Research Center, Cleveland, OH, USA

Thermostructural Properties Of Sic/Sic Panels With 2.5d And 3d Fiber Architectures

Yun, H. M.; DeCarlo, J. A.; Bhatt, R. H.; Jaskowiak, M. H.; [2005]; 1 pp.; In English; 29th Annual Conference on Composites, Materials, and Structures, 24-28 Jan. 2005, Cocoa Beach, FL, USA

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CMC hot-section components in advanced engines for power and propulsion will typically require high cracking strength, high ultimate strength and strain, high creep-rupture resistance, and high thermal conductivity in all directions. In the past, NASA has demonstrated fabrication of a variety of SiC/SiC flat panels and round tubes with various 2D fiber architectures using the high-modulus high-performance Sylramic-iBN SiC fiber and SiC-based matrices derived by CVI, MI, and/or PIP processes. The thermo-mechanical properties of these CMC have shown state-of-the-art performance, but primarily in the in-plane directions. Currently NASA is extending the thermostructural capability of these SiC/SiC systems in the thru-thickness direction by using various 2.5D and 3D fiber architectures. NASA is also using specially designed fabrication steps to optimize the properties of the BN-based interphase and SiC-based matrices. In this study, Sylramic-iBN/SiC panels with 2D plain weave, 2.5D satin weave, 2.5D ply-to-ply interlock weave, and 3D angle interlock fiber architectures, all woven at AITI, were fabricated using matrix densification routes previously established between NASA and GEPSC for CVI-MI processes and between NASA and Starfire-Systems for PIP processes. Introduction of the 2.5 D fiber architecture along with an improved matrix process was found to increase inter-laminar tensile strength from 1.5 -2 to 3 - 4 ksi and thru-thickness thermal conductivity from 15-20 to 30-35 BTU/ft.hr.F with minimal reduction in in-plane strength and creep-rupture properties. Such improvements should reduce thermal stresses and increase the thermostructural operating envelope for SiC/SiC engine components. These results are analyzed to offer general guidelines for selecting fiber architectures and constituent processes for high-performance SiC/SiC engine components.

Author

Silicon Carbides; Fabrication; Mechanical Properties; Panels; Ceramic Matrix Composites; Fibers; Thermodynamic Properties

20050203676 NASA Langley Research Center, Hampton, VA, USA

Scaling the Non-linear Impact Response of Flat and Curved Composite Panels

Ambur, Damodar R.; Chunchu, Prasad B.; Rose, Cheryl A.; Feraboli, Paolo; Jackson, Wade C.; [2005]; 15 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-719-55-TD

Report No.(s): AIAA Paper 2005-2224; No Copyright; Avail: CASI; [A03](#), Hardcopy

The application of scaling laws to thin flat and curved composite panels exhibiting nonlinear response when subjected to low-velocity transverse impact is investigated. Previous research has shown that the elastic impact response of structural configurations exhibiting geometrically linear response can be effectively scaled. In the present paper, a preliminary experimental study is presented to assess the applicability of the scaling laws to structural configurations exhibiting geometrically nonlinear deformations. The effect of damage on the scalability of the structural response characteristics, and the effect of scale on damage development are also investigated. Damage is evaluated using conventional methods including C-scan, specimen de-plying and visual inspection of the impacted panels. Coefficient of restitution and normalized contact duration are also used to assess the extent of damage. The results confirm the validity of the scaling parameters for elastic impacts. However, for the panels considered in the study, the extent and manifestation of damage do not scale according to

the scaling laws. Furthermore, the results indicate that even though the damage does not scale, the overall panel response characteristics, as indicated by contact force profiles, do scale for some levels of damage.

Author

Composite Structures; Curved Panels; Nonlinearity; Scaling Laws; Flat Surfaces

20050203677 NASA Glenn Research Center, Cleveland, OH, USA

Thermal Conductivity of Alumina-reinforced Zirconia Composites

Bansal, Narottam P.; [2005]; 1 pp.; In English; 107th Annual Meeting and Exposition of the American Ceramic Society, 10-13 Apr. 2005, Baltimore, MD, USA

Contract(s)/Grant(s): 22-066-20-06; No Copyright; Avail: Other Sources; Abstract Only

10-mol% yttria-stabilized zirconia (10SZ) - alumina composites containing 0-30 mol% alumina were fabricated by hot pressing at 1500 C in vacuum. Thermal conductivity was determined at various temperatures using a steady-state laser heat flux technique. Thermal conductivity of the composites increased with increase in alumina content. Composites containing 0, 5, and 10-mol% alumina did not show any change in thermal conductivity with temperature. However, those containing 20 and 30-mol% alumina showed a decrease in thermal conductivity with increase in temperature. The measured values of thermal conductivity were in good agreement with those calculated from the Maxwell-Eucken model where one phase is uniformly dispersed within a second major continuous phase.

Author

Zirconium Oxides; Yttria-Stabilized Zirconia; Aluminum Oxides; Thermal Conductivity; Heat Flux; Composite Materials

20050203703 NASA Glenn Research Center, Cleveland, OH, USA

Scanning Ultrasonic Spectroscopy System Developed for the Inspection of Composite Flywheels

Martin, Richard E.; Baaklini, George Y.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Composite flywheels are being considered as replacements for chemical batteries aboard the International Space Station. A flywheel stores energy in a spinning mass that can turn a generator to meet power demands. Because of the high rotational speeds of the spinning mass, extensive testing of the flywheel system must be performed prior to flight certification. With this goal in mind, a new scanning system has been developed at the NASA Glenn Research Center for the nondestructive inspection of composite flywheels and flywheel subcomponents. The system uses ultrasonic waves to excite a material and examines the response to detect and locate flaws and material variations. The ultrasonic spectroscopy system uses a transducer to send swept-frequency ultrasonic waves into a test material and then receives the returning signal with a second transducer. The received signal is then analyzed in the frequency domain using a fast Fourier transform. A second fast Fourier transform is performed to examine the spacing of the peaks in the frequency domain. The spacing of the peaks is related to the standing wave resonances that are present in the material because of the constructive and destructive interferences of the waves in the full material thickness as well as in individual layers within the material. Material variations and flaws are then identified by changes in the amplitudes and positions of the peaks in both the frequency and resonance spacing domains. This work, conducted under a grant through the Cleveland State University, extends the capabilities of an existing point-by-point ultrasonic spectroscopy system, thus allowing full-field automated inspection. Results of an ultrasonic spectroscopy scan of a plastic cylinder with intentionally seeded flaws. The result of an ultrasonic spectroscopy scan of a plastic cylinder used as a proof-of-concept specimen is shown. The cylinder contains a number of flat bottomed holes of various sizes and shapes. The scanning system was able to successfully detect all the defects in the material. Ultrasonic spectroscopy results for a second specimen are shown along with a conventional ultrasonic C-scan. The second specimen is a section of a flywheel subcomponent that has a series of drilled holes and notches. This specimen is employed as a defect detection standard to evaluate the various nondestructive evaluation methods under consideration. Scanning results demonstrate the ability of the system to detect flaws on the order of 10 mils in the radial direction and 5 mils in the circumferential direction. Work conducted to date has shown that scanning ultrasonic spectroscopy is a viable tool for the inspection of composite flywheel systems. Ongoing development work is focused on refining the system and scanning parameters for improved resolution and defect detection.

Author

Flywheels; Mechanical Properties; Scanners; Ultrasonic Spectroscopy; Composite Materials

20050203860 NASA Glenn Research Center, Cleveland, OH, USA

Foreign Object Damage Resistance of Uncoated and EBC Coated SiC/SiC Composites

Bhatt, R. T.; Choi, S. R.; Cosgriff, L. M.; Fox, D.; Lee, K. N.; [2004]; 1 pp.; In English; The HTCMC-5 Conference, 12-15 Sep. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

SiC/SiC composites fabricated by the melt infiltration method are candidate materials for the turbine components such as combustor liners, nozzle vanes and blades because of their high temperature strength, and thermal conductivity. To avoid surface recession in a combustion environment containing moisture, these materials also require an environmental barrier coating (EBC). Under thermal loading condition alone, the EBC coated SiC/SiC components show microstructural and strength stability after -1 5000 hr exposure to 1200°C in combustion environment. However, the stability of SiC/SiC composites under impact conditions is not fully understood. In this study, both uncoated and EBC coated SiC/SiC composite specimens were impact tested by steel-ball projectiles at room temperature and at 1300 C in air. After impact, the specimens were analyzed under a scanning electron microscope to assess coating damage, and then tensile and bend tested at room temperature to determine their residual strength. The extent of coating and substrate damage with increasing projectile velocity was imaged and analyzed using nondestructive evaluation (NDE) methods such as micro focus x-ray radiography, tomography, and thermal wave imaging. The mechanical property results of impacted specimens are correlated with the NDE results and the scanning electron microscopy (SEM) observations. Influence of projectile velocity on impact damage of the coating/substrate, and the implication coating damage on durability of the composite will be discussed.

Author

Substrates; Composite Materials; Silicon Carbides; Infiltration; Vanes; Turbines; Thermal Conductivity; Protective Coatings

20050203884 NASA Glenn Research Center, Cleveland, OH, USA

MAC/GMC Code Enhanced for Coupled Electromagnetothermoelastic Analysis of Smart Composites

Bednarczyk, Brett A.; Arnold, Steven M.; Aboudi, Jacob; Research and Technology 2001; March 2002; 5 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Intelligent materials are those that exhibit coupling between their electromagnetic response and their thermomechanical response. This coupling allows smart materials to react mechanically (e.g., an induced displacement) to applied electrical or magnetic fields (for instance). These materials find many important applications in sensors, actuators, and transducers. Recently interest has arisen in the development of smart composites that are formed via the combination of two or more phases, one or more of which is a smart material. To design with and utilize smart composites, designers need theories that predict the coupled smart behavior of these materials from the electromagnetothermoelastic properties of the individual phases. The micromechanics model known as the generalized method of cells (GMC) has recently been extended to provide this important capability. This coupled electromagnetothermoelastic theory has recently been incorporated within NASA Glenn Research Center's Micromechanics Analysis Code with Generalized Method of Cells (MAC/GMC). This software package is user friendly and has many additional features that render it useful as a design and analysis tool for composite materials in general, and with its new capabilities, for smart composites as well.

Derived from text

Applications Programs (Computers); Composite Materials; Design Analysis; Electric Fields; Magnetic Fields

20050203891 NASA Glenn Research Center, Cleveland, OH, USA

Advanced SiC/SiC Ceramic Composites For Gas-Turbine Engine Components

Yun, H. M.; DiCarlo, J. A.; Easler, T. E.; September 06, 2004; 1 pp.; In English; ASME Turbo Expo 2005, 6-9 Jun. 2005, Reno-Tahoe, NV, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

NASA Glenn Research Center (GRC) is developing a variety of advanced SiC/SiC ceramic composite (ASC) systems that allow these materials to operate for hundreds of hours under stress in air at temperatures approaching 2700 F. These SiC/SiC composite systems are lightweight (approximately 30% metal density) and, in comparison to monolithic ceramics and carbon fiber-reinforced ceramic composites, are able to reliably retain their structural properties for long times under aggressive gas-turbine engine environments. The key for the ASC systems is related first to the NASA development of the Sylramic-iBN Sic fiber, which displays higher thermal stability than any other SiC- based ceramic fibers and possesses an in-situ grown BN surface layer for higher environmental durability. This fiber is simply derived from Sylramic Sic fiber type that is currently produced at ATK COI Ceramics (COIC). Further capability is then derived by using chemical vapor infiltration (CVI) and/or polymer infiltration and pyrolysis (PIP) to form a Sic-based matrix with high creep and rupture resistance as well as high thermal conductivity. The objectives of this study were (1) to optimize the constituents and processing parameters for a Sylramic-iBN fiber reinforced ceramic composite system in which the Sic-based matrix is formed at COIC almost entirely by PIP (full PIP approach), (2) to evaluate the properties of this system in comparison to other 2700 F Sylramic-iBN systems in which the matrix is formed by full CVI and CVI + PIP, and (3) to examine the pros and cons of the full PIP approach for fabricating hot-section engine components. A key goal is the development of a composite system with low porosity, thereby providing high modulus, high matrix cracking strength, high interlaminar strength, and high thermal conductivity, a major property requirement for engine components that will experience high thermal gradients during service. Other key composite

property goals are demonstration at high temperatures of high environmental resistance and high creep resistance, which in turn will result in long component life. Data are presented from a variety of laboratory tests on simple two-dimensional panels that examine these properties and compare the performance of the optimized full PIP system with those of the full CVI and CVI + PIP hybrid systems. Underlying mechanisms for performance differences in the various systems are discussed. Remaining issues for further property enhancement and for application of the full PIP approach for engine components are also discussed, as well as on-going approaches at NASA to solve these issues.

Author

Ceramics; Gas Turbine Engines; Silicon Carbides; Composite Materials; Fabrication

20050203980 NASA Marshall Space Flight Center, Huntsville, AL, USA

Film Delivery Module For Fiber Placement Fabrication of Hybridized Composite Structures

Hulcher, Anthony Bruce; Young, Greg; [2005]; 1 pp.; In English; Society for Advancement of Materials and Process Engineering International Symposium and Exhibition, 1-5 May 2005, Long Beach, CA, USA; Copyright; Avail: Other Sources; Abstract Only

A new fabrication technology has been developed at the NASA Marshall Space Flight Center that will allow for the fabrication of hybridized composite structures using fiber placement processing. This technology was originally developed in response to a need to address the issue of hydrogen permeation and microcracking in cryogenic propellant tanks. Numerous thin polymeric and metallized films were investigated under low temperatures conditions for use as barrier films in a composite tank. Manufacturing studies conducted at that time did not address the processing issues related to fabrication of a hybridized tank wall. A film processing head was developed that will allow for the processing of thin polymeric and metallized films, metallic foils, and adhesives using fiber placement processing machinery. The film head is designed to enable the simultaneous processing of film materials and composite tape/tow during the composite part layup process and is also capable of processing the film during an independent operation. Several initial demonstrations were conducted to assess the performance of the film module device. Such assessments included film strip lay-up accuracy, capability to fabricate panels having internal film liners, and fabrication of laminates with embedded film layers.

Author

Composite Structures; Fabrication; Metal Films; Modules; Fibers

20050203991 Cleveland State Univ., Cleveland, OH, USA

Current Issues with Environmental Barrier Coatings for Ceramics and Ceramic Composites

Lee, Kang N.; [2004]; 1 pp.; In English; International Symposium on New Frontier of Advanced Si-Based Ceramics and Composites, 20-23 Jun. 2004, Geyongju, Korea, Republic of
Contract(s)/Grant(s): WBS 22-714-30-17; WBS 22-714-30-23; No Copyright; Avail: Other Sources; Abstract Only

The environmental barrier coating (EBC) for SiC/SiC ceramic matrix composites and Si₃N₄ ceramics is an emerging field as the application of silicon-based ceramics in the gas turbine engine hot section is on the horizon, both for aero and industrial gas turbines. EBC is an enabling technology for silicon-based ceramics because these materials without an EBC cannot be used in combustion environments due to rapid surface recession. Significant progress in EBC development has been made during the last decade through various government-sponsored programs. Current EBCs are based on silicon, mullite (3Al₂O₃-2SiO₂) and BSAS (barium strontium aluminum silicate with celsian structure). Volatility of BSAS, BSAS-silica chemical reaction, and low melting point of silicon limit temperature capability of current EBCs to about 1350 C for long-term applications. There is a need for higher temperature EBCs as the temperature capability of silicon-based ceramics continue to increase. Therefore, research is underway to develop EBCs with improved temperature capability compared to current EBCs. The current status and issues with the advanced EBC development efforts will be discussed.

Author

Ceramic Matrix Composites; Coatings; Protective Coatings; Silicon Carbides

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category 34 *Fluid Dynamics and Thermodynamics*. For astrochemistry see category 90 *Astrophysics*.

20050199715 Ohio Aerospace Inst., OH, USA

Synthesis Characterization and Decomposition Studies of tris[N-N-dibenzylidithiocarbato]Indium (III) Chemical Spray Deposition of Polycrystalline CuInS₂ on Copper Films

Hehemann, David G.; Lau, J. Eva; Harris, Jerry D.; Hoops, Michael D.; Duffy, Norman V.; [2005]; 9 pp.; In English
Contract(s)/Grant(s): 22-319-20-A1; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper presents the results of the synthesis characterization and decomposition studies of tris[N-N-dibenzylidithiocarbato]Indium (III) with chemical spray deposition of polycrystalline CuInS₂ on Copper Films.

CASI

Synthesis (Chemistry); Decomposition; Polycrystals; Copper Sulfides; Indium Sulfides; Metal Films; Deposition

20050200927 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Decay of Particle Concentration as a Function of Rotation Rate in a Rotating Drum Chamber

Sutton, Tiffany; Apr. 2005; 21 pp.; In English

Contract(s)/Grant(s): Proj-ACB2

Report No.(s): AD-A435579; ECBC-TR-436; No Copyright; Avail: CASI; [A03](#), Hardcopy

Rotating drum chambers are used to keep aerosol particles suspended for an extended period of time to study aging effects. The drums are designed to rotate on a horizontal axis, using centrifugal force to counteract the effects of gravity on small particles. Theoretically, there are different rotation rates for different particle sizes that optimize suspension time. Several different methods have been used to calculate the optimal rotation rates with varying results. This report will compare these mathematical models to experimental results.

DTIC

Aerosols; Particle Decay; Rotation

20050200988 Michigan Technological Univ., Houghton, MI USA

Modeling of Nanotube-Reinforced Polymer Composites

Gao, Xin-Lin; Jan. 2003; 8 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0442

Report No.(s): AD-A435697; MTU-PROPOSAL-030916; AFRL-SR-AR-TR-05-0293; No Copyright; Avail: CASI; [A02](#), Hardcopy

Carbon nanotubes have been identified as promising reinforcing materials for high-performance nanocomposites. Reliable structural applications of carbon nanotube-reinforced composites depend on accurate understanding of their mechanical behavior. Efforts have been made to characterize the mechanical properties of the said nanocomposites. These studies, being typically based on experimental measurements or molecular dynamics simulations, tend to be expensive and configuration/material specific. The use of continuum-based models can mitigate these difficulties and is, therefore, very desirable. Two continuum-based models were developed in the course of this project, one for predicting effective elastic properties of and the other for describing interfacial load transfer in carbon nanotube-reinforced polymer composites.

DTIC

Carbon Nanotubes; Composite Materials; Nanotubes; Polymers; Reinforcing Materials

20050201023 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Potential Usage of Aqueous Alum for Decomposition of Chemical Warfare Agents Part 1: Reactions with V- and G-Type Agents

Williams, Daniel J.; Bevilacqua, Vicky L.; Creasy, William R.; McGarvey, David J.; Rice, Jeffrey S.; Brevett, Carol A.; De Leon, Christopher L.; Maguire, Kelly J.; Sanders, Melanie J.; Durst, H.; Feb. 2005; 23 pp.; In English

Contract(s)/Grant(s): DAAD13-03-D0017

Report No.(s): AD-A435764; ECBC-TR-431; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objective of this research is to hydrolyze and precipitate G- and V-type CW agents using aluminum sulfate (alum) and/or alum buffer solutions. Soman (GD), O-ethyl-S-2-(DIISOPROPYLAMINO)ETHYL methylphosphonothiolate (VX),

and agent simulants were treated with either aqueous alum, sodium aluminate, or mixtures of the two. Reactions were tracked using ³¹P nuclear magnetic resonance and gas chromatography/mass spectrometry (GC/MS). A basic alum buffer at pH 12.0 and an acidic alum buffer at pH 3.6 were used for most of the studies. VX was unaffected by the acidic buffer, but GD was eliminated from the aqueous acidic buffer within 18 hr, with nearly 50% removed within the first 10 min. Gas chromatography/mass spectrometry confirmed that, after 24 hr, a chloroform extract of the precipitate formed in this reaction contained 4 +/- 1% of the original GD.

DTIC

Alum; Chemical Warfare; Decomposition

20050201030 Akron Univ., Akron, OH USA

Nanofiber Production by Gas Jet Spinning Method of Chemical Protective Clothing

Reneker, Darrell; Jan. 2003; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0010

Report No.(s): AD-A435774; No Copyright; Avail: CASI; [A03](#), Hardcopy

The practical usefulness of carbon nanofibers depends on an economical process for creating the fibers. A process described in US Patent No 6,382,526 B1, referred to as the nanofiber by gas jet process, or briefly NGJ process was used to produce nanofibers from mesophase pitch, which were subsequently stabilized and carbonized to carbon fibers. The process produces nanofibers at such a high rate that it was necessary to move it out of a laboratory. Larger equipment and more space were acquired. Samples prepared were successfully stabilized and carbonized. Approximately 125 grams of carbonized nanofibers were sent to Dr. Heidi Schreuder-Gibson at the Army Natick Laboratory. As of this date the large scale machinery, consisting of an extruder, a large filter box, an air compressor, and an oven suitable for stabilizing the pitch fibers are together in one place, and ready to be put into operation. The NGJ apparatus continues to promise high productivity of carbon fibers with diameters around one micron, but further progress toward continuous high rate production was stalled by inadequate operating resources.

DTIC

Carbon Fibers; Gas Jets; Melt Spinning; Protective Clothing

20050201043 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Chemical Vapor Identification Using Field-Based Attenuated Total Reflectance Fourier Transform Infrared Detection and Solid Phase Microextraction

Bryant, Chet K.; LaPuma, Peter T.; Jan. 2005; 111 pp.; In English

Report No.(s): AD-A435792; CI04-1133; No Copyright; Avail: CASI; [A06](#), Hardcopy

Attenuated total reflectance Fourier transform infrared (ATR-FTIR) technology is used to identify chemicals in a liquid or solid phase but not in a vapor phase. This research identified vapor phase chemicals using a field-portable ATR-FTIR spectrometer combined with a solid phase microextraction (SPME) film. Two nerve agent simulants, diisopropyl methylphosphonate (DIMP) and dimethyl methylphosphonate (DMMP), and three polycarbosiloxane polymers were evaluated using a TravelIR(exp TM) ATR-FTIR instrument. A SPME film was adhered to the TravelIR(exp TM) sampling interface to extract and concentrate vapors to be identified by the TravelIR(exp TM). The lowest air concentration identified was 50 ppb DIMP and 250 ppb DMMP. A remote sampling technique where SPME films were exposed to vapors and then transferred to the TravelIR(exp TM) was only able to identify DMMP down to 10 ppm. This research demonstrates it is feasible to use ATR-FTIR to detect vapor phase chemicals when combined with SPME film concentration techniques.

DTIC

Chemical Analysis; Fourier Transformation; Infrared Detectors; Infrared Radiation; Infrared Spectra; Reflectance; Solid Phases; Vapors

20050201049 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Hapsite Gas Chromatography - Mass Spectrometry with Solid Phase Microextraction

Kan, Waikwong; Hook, Gary L.; Jul. 2005; 51 pp.; In English

Report No.(s): AD-A435802; CI04-1138; No Copyright; Avail: CASI; [A04](#), Hardcopy

Rapid air sampling can be accomplished with solid phase microextraction (SPME) to avoid the difficulties of pumps and wet chemistry. Gas chromatography with mass spectrometry (GC/MS) is the gold standard for identifying volatile and semi volatile chemicals. Combining SPME with a portable HAPSITE GC/MS may allow rapid chemical identification outside of a laboratory. Six chemicals at six concentrations were tested using four sample introduction methods. The four methods

included the HAPSITE loop, the HAPSITE with tri-bed concentrator, the HAPSITE with SPME and a field portable GC/MS with SPME. The SPME fiber used was Polydimethylsiloxane (PDMS). The HAPSITE with tri-bed concentrator achieved the lowest detection limits. The HAPSITE and the field portable GC/MS instrument coupled with SPME had similar variability. The relative standard deviation for these instruments was under 25% for most chemicals with concentrations between 1-10 ppm.

DTIC

Chemical Analysis; Gas Chromatography; Mass Spectroscopy; Solid Phases

20050201062 Fluorochem, Inc., Azusa, CA USA

All-Nitrogen Compounds as High Energy Density Materials

Baum, Kurt; Willer, Rodney L.; Bottaro, Jeffrey; Petrie, Mark; Penwell, Paul; Dodge, Allen; Malhotra, Ripu; Jul. 2005; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0119

Report No.(s): AD-A435833; AFRL-SR-AR-TR-05-0305; No Copyright; Avail: CASI; [A02](#), Hardcopy

There is a continuing need for safe, versatile rocket propellants, which are stable, nonvolatile, energetic, and easily demilitarized. Ionic liquids constitute a research area that is little explored for propellant ingredients and provides potential to meet these requirements. Enhanced dissolving power, density and compatibilities with a wide range of propellant ingredients make ionic liquids a very attractive class of materials for advanced state-of-the-art propulsion systems. The extreme polarity of these unique liquid media opens the door to novel burn-rate and ballistic attenuation technologies. The objective of this Phase I SBIR program is to canvass and select the most promising candidates for development of energetic ionic liquid and other high-nitrogen energetic ingredients.

DTIC

Liquids; Nitrogen Compounds; Rocket Propellants

20050201081 Utah Univ., Salt Lake City, UT USA

CHSSI: Scalable Software for Bridging Atomistic and Continuum Simulations

Voth, Gregory A.; Jul. 2005; 7 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0190

Report No.(s): AD-A435867; AFRL-SR-AR-TR-05-0306; No Copyright; Avail: CASI; [A02](#), Hardcopy

A highly parallel simulation software capable of modeling complex systems at the mesoscale was developed and tested. The scaling of the simulation computer code, called TANTALUS, was found to be excellent, due to the novel spatial decomposition algorithm that was developed. TANTALUS was employed to examine a number of complex systems as demonstration projects.

DTIC

Computer Programs; Continuum; Simulation; Solids; Viscosity

20050201097 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Chemical Characterization of the Pyrotechnically Disseminated XM30 Main Gun Signature Simulator

Anthony, J. S.; Haley, Mark V.; Thomson, Sandra A.; Crouse, Charles L.; Jan. 2002; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435915; No Copyright; Avail: Defense Technical Information Center (DTIC)

Development of the Multiple Integrated Laser Engagement System (MILES) 2000 device has been selected as the replacement to the currently used Hoffman systems. On the M1 or M60 tanks, a laser is activated to simulate firing of the main gun, which triggers a signal to the Main Gun Signature Simulator (MGSS) to activate the XM30 simulator. The XM30 simulator was designed to produce a flash and bang so the tank crew will receive a visual as well as an audible confirmation of the firing. The purpose of this study was to pyrotechnically disseminate the XM30 simulators in a controlled chamber environment and to maintain a specified concentration range for chemical characterization of the combustion products. Data was needed prior to material release and for incorporation into the item's Life Cycle Environmental Assessment (LCEA). Characterization was to principally include compounds of toxicological significance such as benzene, formaldehyde and carbon monoxide, but detection of other volatile organic compounds, inorganic metals, and particle size analysis were also performed. The inorganic gases NO_x and SO_x were not analyzed for because previous data had already shown their concentrations to be far below their TLV-TWA's. A detailed mass balance was also well outside the scope of this study. For

it's current use in combat training exercises, this study provides evidence that the combustion products produced by firing of the XM30 simulator are of a safe and non-toxic nature.

DTIC

Guns (Ordnance); Pyrotechnics; Signatures; Simulators; Toxicology

20050201099 Johns Hopkins Univ., Baltimore, MD USA

Nonadiabatic Processes Relevant to HEDMS and Atmospheric Chemistry

Yarkony, David R.; May 2005; 16 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0289

Report No.(s): AD-A435918; AFRL-SR-AR-TR-05-0295; No Copyright; Avail: CASI; [A03](#), Hardcopy

There are three particularly notable aspects to this AFOSR sponsored work. The work with most enduring impact is our study on the polynitrogen molecules, $(\text{CH})_n\text{N}_5$ $n=1,2,3,4$. We found that these molecules have complicated photoelectron spectra owing to the existence of low-lying conical intersections or three-states with little or no symmetry. Further, this study identified a whole class of doublet radicals that are expected to exhibit low-lying three-state conical intersections. In the past, three-state intersections had been virtually ignored as too rare to be of consequence. Thus, these findings require a re-thinking of both the prevalence of three-state conical intersections and the electronic structure of a commonly occurring class of reactive chemical species. Secondly, we have made the electronic structure tools we have developed to locate and analyze two- and three-state conical intersections freely available to the general scientific community through the COLUMBUS suite of electronic structure codes. These extremely efficient multi-reference configuration- interaction-based codes are currently being maintained and extended through the combined efforts of Lischka (Vienna) and Sheppard (Argonne). Finally, there is our theoretical determination of the absorption cross section for the alpha-beta transitions in O_2 and NCl . We are to perform these highly accurate theoretical calculations, which are relevant to the energy transfer iodine laser systems, in a timely manner because of our participation in the AFOSR theoretical chemistry program.

DTIC

Atmospheric Chemistry; Chemical Lasers; Computational Chemistry; Energy Transfer; Heat Transfer; Radicals

20050201103 Triosyn Corp., Burlington, VT USA

An Effective CB Material from Combined Components of Triosyn(Trademark) Resin and Surface Enhanced Carbon

Di Ionno, Lucy; St-Louis, Jean-Pierre; Bourget, Stephane; Messier, Pierre J.; Jan. 2002; 12 pp.; In English

Report No.(s): AD-A435923; No Copyright; Avail: Defense Technical Information Center (DTIC)

The tremendous concern over the threat of biological and chemical warfare agents has necessitated the research and development of greatly improved methods for the absorption and catalytic destruction of these toxic contaminants. With the use of proven biocidal efficiency of the Triosyn(Trademark) iodine resin and carbon based new materials, the research objective is to produce a barrier possessing the dual properties of decontaminating both chemical warfare and biological agents. Vapor testing performed allowed for the down selection of prototypes; POX3/1/0/A, OX5H/C, and OX5H/D which displayed excellent absorption capacity, microbiological reduction rates greater than 99.9% against MS2 phage, and displayed non-toxic threshold limit values.

DTIC

Biological Weapons; Carbon; Chemical Warfare; Resins

20050201104 Science and Technology Corp., Hampton, VA USA

Quantification of Lewisite in Air by Liquid Chromatography Mass Spectrometry (LC/MS)

Ercanbrack, Wesley; Sheffield, Sherry; Freudenberger, Steve; Jenkins, Aaron; Jan. 2002; 9 pp.; In English

Report No.(s): AD-A435925; No Copyright; Avail: Defense Technical Information Center (DTIC)

It has been determined that lewisite will hydrolyze and oxidize under ambient conditions to form chlorovinyl arsonic acid (CVRA) which is an As+5 compound. Most published methods for the analysis of lewisite require the derivatization of lewisite with a dithiol compound to produce a compound that can be analyzed using a gas chromatograph. The derivatization methods generally have poor reproducibility and precision which is due to the fact that the CVRA compound will not be derivatized by the dithiol compound. The authors have established an air monitoring method that will account for both lewisite and CVRA sampled from the air during various sampling periods. Both lewisite and CVRA are extracted off a solid sorbent tube and analyzed by liquid chromatography/mass spectrometry.

DTIC

Air Masses; Gas Chromatography; Liquid Chromatography; Mass Spectroscopy

20050201106 General Accounting Office, Washington, DC USA

DOD Operational Ranges: More Reliable Cleanup Cost Estimates and a Proactive Approach to Identifying Contamination Are Needed

May 2004; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435939; GAO-04-601; No Copyright; Avail: Defense Technical Information Center (DTIC)

For decades, the Department of Defense (DOD) has tested and fired munitions on millions of acres of operational ranges. These munitions contain various constituents such as lead, trinitrotoluene (TNT), and ammonium perchlorate salt (perchlorate) that are, in some instances, known or suspected of causing health effects such as damage to the central and peripheral nervous systems, cancer, and interfering with thyroid function. Concerns about the potential cost to clean up munitions prompted Congress to require that DOD develop an estimate for what it would cost to clean up its operational ranges. The National Defense Authorization Act for Fiscal Year 2002 required DOD to provide (1) a comprehensive assessment of unexploded ordnance, discarded military munitions, and munitions constituents at current and former DOD facilities; and (2) an estimate of the aggregate projected cost of remediation (cleanup) at operational ranges,¹ stated as a range of costs, including a low and high estimate. As of April 2003, DOD identified 10,444 operational ranges located in the USA and its territories, with Army operational ranges accounting for 94 percent of the total. DOD estimated it would cost between \$16 billion and \$165 billion to clean up unexploded ordnance, discarded military munitions, and munitions constituents on these operational ranges.

DTIC

Ammonium Perchlorates; Cleaning; Contamination; Cost Estimates; Identifying; Public Health

20050201126 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Room Temperature Mineralization of Chemical Warfare Agents Using Hydrogen Peroxide - Pd/C

Wagner, George W.; Procell, Lawrence R.; Yang, Yu-Chu; Jan. 2002; 6 pp.; In English

Report No.(s): AD-A435998; No Copyright; Avail: Defense Technical Information Center (DTIC)

The deep oxidation of toxic organics and chemical warfare (CW) agent simulants using Pd/C and dioxygen or hydrogen peroxide at 80-90 deg C was recently demonstrated by Sen et al.¹ This process offers a chemical means of destroying CW materials in a manner traditionally achievable only by incineration. Our investigations of the common simulant dimethyl methylphosphonate (DMMP) have shown mineralization to inorganic phosphate using H₂O₂ Pd/C at 90 C. Oxidative cleavage of DMMP to methylphosphonic acid is most effective at room temperature, apparently due to reduced H₂O₂ decomposition. Similarly, GD and VX also showed oxidative cleavage at room temperature, and formation of inorganic phosphate. For HD and its simulant thiodiglycol, mineralization is also evident at room temperature.

DTIC

Chemical Warfare; Hydrogen Peroxide; Room Temperature

20050201128 California Univ., Santa Barbara, CA USA

Molybdate/Peroxide Oxidation of Mustard in Microemulsions

Procell, Lawrence R.; Wagner, George W.; Yang, Yu-Chu; Bunton, Clifford A.; Jan. 2002; 5 pp.; In English

Report No.(s): AD-A436000; No Copyright; Avail: Defense Technical Information Center (DTIC)

Environmentally friendly and non-corrosive methods to decontaminate the blister agent mustard (HD), bis(2-chloroethyl) sulfide, are currently being developed. HD may be rendered non-vesicant by oxidation to the corresponding sulfoxide. Results will be presented for the use of the mildly-basic molybdate/ peroxide oxidant system to achieve this transformation. Reactions are performed in microemulsions to enable the dissolution of oily, water-insoluble mustard.

DTIC

Emulsions; Molybdates; Oxidation; Peroxides

20050201598 Lund Univ., Sweden

Reduction of Ammonia and Tar in Pressurized Biomass Gasification

Wang, W.; Olofsson, G.; January 2005; 16 pp.; In English

Report No.(s): DE2005-836332; No Copyright; Avail: Department of Energy Information Bridge

The present paper intended to present the results of parametric study of the formation of ammonia and tar under pressurized gasification conditions. By the use of multivariate data analysis, the effects of operating parameters were determined and their influences could be quantified. In order to deal with cases in which high levels of ammonia and tar were

produced, study of catalytic hot gas cleaning was performed, aiming to discuss the removal efficiency and test catalysts.
NTIS

Ammonia; Biomass; Cleaning; Gasification; High Temperature Gases; Tars

20050201931 Naval Research Lab., Washington, DC, USA

Metal Ion Analysis Using Near-Infrared Dyes and the 'Laboratory-on-a-Chip'. (Report for September 15, 1998-September 15, 2001)

Collins, G. E.; Sep. 2001; 20 pp.; In English

Report No.(s): DE2005-832998; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this project was to establish the groundwork for developing a portable, toxic metal ion sensor capable of sensitively and rapidly detecting trace levels of hazardous waste metal ions contaminating building materials evident at DOE waste sites. By enabling selective metal ion analysis in the field, timely decisions with regards to the proper choice of remediation tools to be applied in a given activity, accurate sorting of contaminated and noncontaminated materials, and the immediated determination of the success or failure of a given clean up effort can be assessed directly, in real time. Such a sensor would enable savings in time and money, while additionally minimizing exposure, benefiting health criteria.

NTIS

Chips; Dyes; Metal Ions

20050201969 Lawrence Livermore National Lab., Livermore, CA USA

Silica Scale Inhibition: Effect of Organic Additives on Polymerization

Leif, R.; Bourcier, W.; Bruton, C.; Sep. 22, 2005; 16 pp.; In English

Report No.(s): DE2005-15013195; UCRL-JC-140621; No Copyright; Avail: Department of Energy Information Bridge

The problem of silica scale formation is common in geothermal power production facilities worldwide. Factors such as variable fluid compositions, different plant operating conditions, and the complex nature of silica polymerization reactions contribute to make scale inhibition a difficult problem. Scale forms by molecular and particle (colloid) deposition. Colloids are produced by polymerization of aqueous silica. One approach to controlling silica scale is to use water-soluble organic polymers that inhibit or delay the onset of polymerization. Laboratory batch experiments are being performed to test the ability of commercially available antiscalants to extend the length of the induction period during silica polymerization. The induction period should be long enough to allow the brine to pass through the surface and reinjection facilities before colloid deposition occurs. Potential antiscalants will then be tested under field conditions at a geothermal power plant.

NTIS

Additives; Polymerization; Scale Effect; Silicon Dioxide

20050201995 Lawrence Livermore National Lab., Livermore, CA USA

Mechanical Properties and Corrosion Characteristics of Thermally Aged Alloy 22

Rebak, R. B.; Crook, P.; May 30, 2002; 18 pp.; In English

Report No.(s): DE2005-15013566; UCRL-JC-148653; No Copyright; Avail: Department of Energy Information Bridge

Alloy 22 (UNS N06022) is a candidate material for the external wall of the high level nuclear waste containers for the potential repository site at Yucca Mountain. In the mill-annealed (MA) condition, Alloy 22 is a single face centered cubic phase. When exposed to temperatures on the order of 600 deg. C and above for times higher than 1 h, this alloy may develop secondary phases that reduce its mechanical toughness and corrosion resistance. The objective of this work was to age Alloy 22 at temperatures between 482 deg. C and 760 deg. C for times between 0.25 h and 6,000 h and to study the mechanical and corrosion performance of the resulting material. Aging was carried out using wrought specimens as well as gas tungsten arc welded (GTAW) specimens. Mechanical and corrosion testing was carried out using ASTM standards. Results show that the higher the aging temperature and the longer the aging time, the lower the impact toughness of the aged material and the lower its corrosion resistance. However, extrapolating both mechanical and corrosion laboratory data predicts that Alloy 22 will remain corrosion resistant and mechanically robust for the projected lifetime of the waste container.

NTIS

Aging (Materials); Corrosion; Corrosion Resistance; Mechanical Properties; Radioactive Wastes; Temperature Effects

20050202002 Lawrence Livermore National Lab., Livermore, CA USA

Electrochemical Behavior of Alloy 22 IN 5M CaCl₂

Ilevbare, G. O.; May 30, 2002; 26 pp.; In English

Report No.(s): DE2005-15013492; UCRL-JC-148598; No Copyright; Avail: Department of Energy Information Bridge

This work is in support of the design and construction of the potential geological nuclear waste repository in Yucca Mountain Nevada. Therefore, the environmental considerations of importance are those pertaining to the design and construction of high-level radioactive waste packages for the Yucca Mountain Project (YMP). The design of the waste package as stipulated in the License Design Selection Report, calls for a double walled canister. The proposed material for the outer barrier of the waste package is Alloy 22 (Unified Numbering System (UNS) N06022), the corrosion resistant material (CRM). Alloy 22 is expected to provide a reasonable level of 'kinetic' immunity from general and localized corrosion for the waste packages under the prevailing environmental condition in Yucca Mountain. Kinetic immunity would ensure a low rate of passive dissolution, and negligible chance of generating damaging pits or crevices. The proposed material for the inner barrier of the waste package is stainless steel 316. The primary role of this layer is structural reinforcement.

NTIS

Corrosion Resistance; Radioactive Wastes; Nickel Alloys

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20050199666 Oak Ridge National Lab., TN USA

Use of Electrochemical Noise to Assess Corrosion in Kraft Continuous Digesters

Pawel, S. J.; Aug. 2004; 46 pp.; In English

Report No.(s): DE2005-838102; No Copyright; Avail: Department of Energy Information Bridge

Electrochemical noise (EN) probes were deployed in two continuous kraft digesters at a variety of locations representative of corrosion throughout the vessels. Current and potential noise, the temperature at each probe location, and the value of up to 60 process parameters (flow rates, liquor chemistry, etc.) were monitored continuously during each experiment. The results indicate that changes in furnish composition and process upsets were invariably associated with concurrent substantial changes in EN activity throughout the vessels. Post-test evaluation of the mild steel electrode materials in both vessels confirmed general corrosion of a magnitude consistent with historical trends in the respective vessels as well as values qualitatively (and semi-quantitatively) related to EN current sums for each electrode pair. Stainless steel electrodes representing 309LSi and 312 overlay repairs exhibited zero wastage corrosion--as did the actual overlays--but the EN data indicated periodic redox activity on the stainless steel that varied with time and position within the vessel. Little or no correlation between EN probe activity and other operational variables was observed in either vessel. Additional details for each digester experiment are summarized.

NTIS

Carbon Steels; Electrochemical Corrosion; Electrodes; Stainless Steels

20050199750 NASA Glenn Research Center, Cleveland, OH, USA

Techniques Optimized for Reducing Instabilities in Advanced Nickel-Base Superalloys for Turbine Blades

MacKay, Rebecca A.; Locci, Ivan E.; Garg, anita; Ritzert, Frank J.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The High-Speed Research (HSR) Airfoil Alloy program developed fourth-generation single-crystal superalloys with up to an 85 F increase in creep rupture capability over current production airfoil alloys. Recent results have been generated at the NASA Glenn Research Center on these fourth-generation alloys, but in coated form, for subsonic turbine blade applications under NASA's Ultra-Efficient Engine Technology (UEET) Program. One goal for UEET is to optimize the airfoil alloy/thermal barrier coating system for 3100 F turbine inlet temperatures. The state-of-the art turbine blade airfoil system consists of a superalloy single crystal that provides the basic mechanical performance of the airfoil. A thermal barrier coating is used to reduce the temperature of the base superalloy, and a bondcoat is deposited between the base material and the thermal barrier coating. The bondcoat improves the oxidation and corrosion resistance of the base superalloy and improves the spallation resistance of the thermal barrier coating. A commercial platinum aluminide bondcoat was applied to the HSR-developed alloys, and a diffusion zone developed as a result of interaction between the bondcoat and the superalloy. Optimized strength is obtained for superalloys when the refractory element content is high and the limits of microstructural stability are approached or exceeded slightly. For fourthgeneration alloys, instability leads to the formation of topologically close packed (TCP) phases, which form internally in the superalloy, and a secondary reaction zone (SRZ), which forms under the diffusion zone. There was a concern that excessive quantities of either TCP or SRZ might decrease the mechanical properties of the superalloy, with SRZ thought to be particularly detrimental and its formation unpredictable. Thus, an SRZreduction effort was initiated in the NASA UEET Program so that methods developed during the HSR project could be

optimized further to reduce or eliminate the SRZ. An SRZ is a three-phase constituent composed of TCP and stringers of gamma phase in a matrix of gamma prime. An incoherent grain boundary separates the SRZ from the gammagamma prime microstructure of the superalloy. The SRZ is believed to form as a result of local chemistry changes in the superalloy due to the application of the diffusion aluminide bondcoat. Locally high surface stresses also appear to promote the formation of the SRZ. Thus, techniques that change the local alloy chemistry or reduce surface stresses have been examined for their effectiveness in reducing SRZ. These SRZ-reduction steps are performed on the test specimen or the turbine blade before the bondcoat is applied. Stressrelief heat treatments developed at NASA Glenn have been demonstrated to reduce significantly the amount of SRZ that develops during subsequent high-temperature exposures. Stress-relief heat treatments reduce surface stresses by recrystallizing a thin surface layer of the superalloy. However, in alloys with very high propensities to form SRZ, stress relief heat treatments alone do not eliminate SRZ entirely. Thus, techniques that modify the local chemistry under the bondcoat have been emphasized and optimized successfully at Glenn. One such technique is carburization, which changes the local chemistry by forming submicron carbides near the surface of the superalloy. Detailed characterizations have demonstrated that the depth and uniform distribution of these carbides are enhanced when a stress relief treatment and an appropriate surface preparation are employed in advance of the carburization treatment. Even in alloys that have the propensity to develop a continuous SRZ layer beneath the diffusion zone, the SRZ has been completely eliminated or reduced to low, manageable levels when this combination of techniques is utilized. Now that the techniques to mitigate SRZ have been established at Glenn, TCP phase formation is being emphasized in ongoing work under the UEET Program. The limitsf stability of the fourth-generation alloys with respect to TCP phase formation are currently being defined along with high-temperature creep rupture properties. In addition, a regression model is being developed at Glenn for the prediction of the presence of TCP phase in the microstructure and SRZ under the diffusion zone. The model is based on a design-of-experiments methodology with emphasis on the potential synergistic effects of alloying elements.

Author

Nickel Alloys; Stability; Optimization; Turbine Blades; Heat Resistant Alloys; Experiment Design; Mathematical Models

20050199753 NASA Glenn Research Center, Cleveland, OH, USA

Dual Microstructure Heat Treatment of a Nickel-Base Disk Alloy Assessed

Gayda, John; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Gas turbine engines for future subsonic aircraft will require nickel-base disk alloys that can be used at temperatures in excess of 1300 F. Smaller turbine engines, with higher rotational speeds, also require disk alloys with high strength. To address these challenges, NASA funded a series of disk programs in the 1990's. Under these initiatives, Honeywell and Allison focused their attention on Alloy 10, a high-strength, nickel-base disk alloy developed by Honeywell for application in the small turbine engines used in regional jet aircraft. Since tensile, creep, and fatigue properties are strongly influenced by alloy grain size, the effect of heat treatment on grain size and the attendant properties were studied in detail. It was observed that a fine grain microstructure offered the best tensile and fatigue properties, whereas a coarse grain microstructure offered the best creep resistance at high temperatures. Therefore, a disk with a dual microstructure, consisting of a fine-grained bore and a coarse-grained rim, should have a high potential for optimal performance. Under NASA's Ultra-Safe Propulsion Project and Ultra-Efficient Engine Technology (UEET) Program, a disk program was initiated at the NASA Glenn Research Center to assess the feasibility of using Alloy 10 to produce a dual-microstructure disk. The objectives of this program were twofold. First, existing dual-microstructure heat treatment (DMHT) technology would be applied and refined as necessary for Alloy 10 to yield the desired grain structure in full-scale forgings appropriate for use in regional gas turbine engines. Second, key mechanical properties from the bore and rim of a DMHT Alloy 10 disk would be measured and compared with conventional heat treatments to assess the benefits of DMHT technology. At Wyman Gordon and Honeywell, an active-cooling DMHT process was used to convert four full-scale Alloy 10 disks to a dual-grain microstructure. The resulting microstructures are illustrated in the photomicrographs. The fine grain size in the bore can be contrasted with the coarse grain size in the rim. Testing (at NASA Glenn) of coupons machined from these disks showed that the DMHT approach did indeed produce a high-strength, fatigue resistant bore and a creep-resistant rim. This combination of properties was previously unobtainable using conventional heat treatments, which produced disks with a uniform grain size. Future plans are in place to spin test a DMHT disk under the Ultra Safe Propulsion Project to assess the viability of this technology at the component level. This testing will include measurements of disk growth at a high temperature as well as the determination of burst speed at an intermediate temperature.

Author

Gas Turbine Engines; Heat Treatment; Mechanical Properties; Microstructure; Nickel Alloys

20050200829 Army Research Lab., Aberdeen Proving Ground, MD USA

Use of Self-Propagating High-Temperature Synthesis Reactions in Refractory Alloy Fabrication

Kecskes, Laszlo J.; Apr. 2005; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1L622105AH84

Report No.(s): AD-A435310; ARL-TR-3465; No Copyright; Avail: CASI; [A03](#), Hardcopy

The titanium carbide (TiC) self-propagating high-temperature synthesis (SHS) reaction was used in a hot-explosive-consolidation process to fabricate tungsten and molybdenum-based alloy billets. In this method, a Ti+C mixture is reacted to provide a source of heat for the refractory precursor powders. As the TiC reaction proceeds, the exterior of the alloy sample heats up rapidly, near or above 2000 deg C, while its interior lags behind, heating up more gradually to 1600 deg C. At the completion of the TiC reaction, the alloy sample's exterior begins to cool, causing the temperature to equilibrate to an isothermal condition. At this time, the sample is compacted to high density by the application of an explosively generated pressure wave. Experiments were conducted to determine the relationship between the geometries of the Ti+C mixture and the alloy sample. For the Ti+C mixture, a doughnut arrangement was found to provide an optimum heating rate and temperature profile to the sample. The effects of the relative amount of the SHS material and alloy sample on the duration of the heating cycle, peak interior temperature, and rate of cooling were studied. The properties of the samples and TiC product were evaluated by density measurements, scanning electron microscopy, energy-dispersive x-ray spectroscopy, and x-ray diffraction analysis. The HEC method and the resultant product structures are described.

DTIC

Fabrication; High Temperature; Refractory Metal Alloys; Self Propagation

20050200984 California Inst. of Tech., Pasadena, CA USA

Caltech Center for Structural and Amorphous Metals

Johnson, William L.; Conner, R. D.; May 2005; 114 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD019-01-1-0525

Report No.(s): AD-A435685; ARO-42478.65-MS; No Copyright; Avail: Defense Technical Information Center (DTIC)

The report summarizes the results of the university Structural Amorphous Metals Program sponsored by ARO/DARPA. It discusses laboratory and theoretical developments in discovery and understanding of Bulk Metallic Glasses, and experiments conducted to characterize the resulting alloys.

DTIC

Amorphous Materials; Metals

20050200992 Northwestern Univ., Evanston, IL USA

Computational Design of Advanced Aeroturbine Materials: Noburnium Cyberalloy

Olson, Gregory B.; Freeman, Arthur J.; Asta, Mark D.; Ghosh, Gautam; Perepezko, John H.; Eberhart, Mark E.; Woodward, C.; Aug. 2004; 38 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0529

Report No.(s): AD-A435704; AFRL-SR-AR-TR-05-0259; No Copyright; Avail: CASI; [A03](#), Hardcopy

Under the AFOSR-MEANS initiative, an optimal combination of electronic-level first-principles calculations and efficient experimentation addresses the accelerated design and development of a new class of Nb-based aeroturbine superalloys.

DTIC

Heat Resistant Alloys; Niobium Alloys; Turbines

20050201599 Lawrence Livermore National Lab., Livermore, CA USA

Shear Modeling: Thermoelasticity at High Temperature and Pressure for Tantalum

Orlikowski, D.; Soderlind, P.; Dec. 14, 2004; 10 pp.; In English

Report No.(s): DE2005-15014351; UCRL-PROC-208581; No Copyright; Avail: Department of Energy Information Bridge

For large-scale constitutive strength models the shear modulus is typically assumed to be linearly dependent on temperature. However, for materials compressed beyond the Hugoniot or in regimes where there is very little experimental data, accurate and validated models must be used. To this end, we present here a new methodology that fully accounts for electron- and ion-thermal contributions to the elastic moduli over broad ranges of temperature (less than 20,000 K) and pressure (less than 10 Mbar). In this approach, the full potential linear muffin-tin orbital (FP-LMTO) method for the cold and electron-thermal contributions is closely coupled with ion-thermal contributions. For the latter two separate approaches are used. In one approach, the quasi-harmonic, ion-thermal contribution is obtained through a Brillouin zone sum of strain

derivatives of the phonons, and in the other a full anharmonic ion-thermal contribution is obtained directly through Monte Carlo (MC) canonical distribution averages of strain derivatives on the multi-ion potential itself. Both approaches use quantum-based interatomic potentials derived from model generalized pseudopotential theory (MGPT). For tantalum, the resulting elastic moduli are compared to available ultrasonic measurements and diamondanvil- cell compression experiments. Over the range of temperature and pressure considered, the results are then used in a polycrystalline averaging for the shear modulus to assess the linear temperature dependence for Ta.

NTIS

High Temperature; Tantalum; Thermoelasticity

20050201669 Northwestern Univ., Evanston, IL USA

Soft Interfaces, Quasicrystals and Tribology

Marks, Laurence D.; Jan. 2005; 8 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0092

Report No.(s): AD-A435776; AFRL-SR-AR-TR-05-0273; No Copyright; Avail: CASI; [A02](#), Hardcopy

An analytical model for dry friction using a combination of dislocation drag and solid-solid interface theory was developed. This model, with no adjustable parameters, gives semi-quantitatively correct numbers for experimental friction coefficients in ultra-high vacuum, and is also consistent with a number of other experimental finding ranging from the formation of contact layers to temperature dependence. Experiments on macroscopic single crystals to explore the angular dependence of solid-solid friction were performed, and found to be consistent with theoretical predictions albeit complicated by noise in the measurements.

DTIC

Tribology; Single Crystals

20050201795 NASA Glenn Research Center, Cleveland, OH, USA

Mechanical Characterization of Reactively Brazed Metal-Composite Joints for Heat Rejection Systems

Morscher, Gregory N.; Asthana, Rajiv; Singh, Mrityunjay; Shpargel, Tarah; [2005]; 1 pp.; In English; 29th International Conference on Advanced Ceramics and Composites; American Ceramic Society, 23-28 Jan. 2005, Cocoa Beach, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

The joining of metal tubes to composite plates is required for heat-rejection components in several space applications. Currently a number of different braze compositions are being evaluated as to their effectiveness. Such tube-plate configurations cannot be represented by traditional methods of testing, e.g., lap joints. The joined region is not between two flat surfaces, but rather between a flat surface and a curved surface. Therefore, several tests have been employed to ascertain the effectiveness of the different braze approaches in tension and in shear that are both simple and representative of the actual system and relatively straightforward in analysis. The results of these 'tube tests' will be discussed for the three different braze compositions, Cu-ABA, Ti-Cu-Sil, and Ti-Cu-Ni. In addition, fracture analysis of the failed joints was performed and offers insights into the cause of joint failure and the distinctions which need to be made between the 'strength' of a joint versus the 'load carrying ability' of a joint.

Author

Soldered Joints; Metal Plates; Metal Joints; Brazing; Plates (Structural Members)

20050201797 NASA Glenn Research Center, Cleveland, OH, USA

Characterization of Cold Sprayed CuCrAl Coated GRCop-84 Substrates for Reusable Launch Vehicles

Raj, S. V.; Barrett, C. A.; Lerch, B. A.; Karthikeyan, J.; Ghosn, L. J.; Haynes, J.; January 2005; 1 pp.; In English; Cold Spray 2004, 27-28 Sep. 2004, Akron, OH, USA; Copyright; Avail: Other Sources; Abstract Only

An advanced Cu-8(at.%)Cr-4%Nb alloy developed at NASA's Glenn Research Center, and designated as GRCop-84, is currently being considered for use as combustor liners and nozzles in NASA's future generations of reusable launch vehicles (RLVs). Despite the fact that this alloy has superior mechanical and oxidation properties compared to many commercially available copper alloys, it is felt that its high temperature and environmental resistance capabilities can be further enhanced with the development and use of suitable coatings. Several coatings and processes are currently being evaluated for their suitability and future down selection. A newly developed CuCrAl has shown excellent oxidation resistance compared to current generation Cu-Cr coating alloys. Cold spray technology for depositing the CuCrAl coating on a GRCop-84 substrate is currently being developed under NASA's Next Generation Launch Technology (NGLT) Propulsion Research and

Technology (PR&T) project. The microstructures, mechanical and thermophysical properties of overlay coated GRCop-84 substrates are discussed.

Author

Copper Alloys; Metal Coatings; Sprayed Coatings; Lining Processes; Heat Resistant Alloys; Thermal Control Coatings

20050201798 NASA Glenn Research Center, Cleveland, OH, USA

Low Pressure Plasma Sprayed Overlay Coatings for GRCop-84 Combustion Chamber Liners for Reusable Launch Vehicles

Raj, S. V.; Barrett, C.; Ghosn, L. J.; Lerch, B.; Robinson, G.; Thorn, G.; January 2005; 1 pp.; In English; ASM Fall Meeting, 18-21 Oct. 2004, Columbus, OH, USA; Copyright; Avail: Other Sources; Abstract Only

An advanced Cu-8(at.%)Cr-4%Nb alloy developed at NASA's Glenn Research Center, and designated as GRCop-84, is currently being considered for use as combustor chamber liners and nozzle ramps in NASA's future generations of reusable launch vehicles (RLVs). However, past experience has shown that unprotected copper alloys undergo an environmental attack called 'blanching' in rocket engines using liquid hydrogen as fuel and liquid oxygen as the oxidizer. Potential for sulfidation attack of the liners in hydrocarbon-fueled engines is also of concern. Protective overlay coatings alloys are being developed for GRCop-84. The development of this coatings technology has involved a combination of modeling, coatings development and characterization, and process optimization. Coatings have been low pressure plasma sprayed on GRCop-84 substrates of various geometries and shapes. Microstructural, mechanical property data and thermophysical results on the coated substrates are presented and discussed.

Author

Protective Coatings; Reusable Launch Vehicles; Linings; Combustion Chambers; Sprayed Coatings; Plasmas (Physics); Copper Alloys

20050201885 NASA Glenn Research Center, Cleveland, OH, USA, Case Western Reserve Univ., Cleveland, OH, USA

Oxidation Behavior of GRCop-84 Copper Alloy Assessed

Thomas-Ogbuji, Linus U.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA's goal of safe, affordable space transportation calls for increased reliability and lifetimes of launch vehicles, and significant reductions of launch costs. The areas targeted for enhanced performance in the next generation of reusable launch vehicles include combustion chambers and nozzle ramps; therefore, the search is on for suitable liner materials for these components. GRCop-84 (Cu-8Cr-4Nb), an advanced copper alloy developed at the NASA Glenn Research Center in conjunction with Case Western Reserve University, is a candidate. The current liner of the Space Shuttle Main Engine is another copper alloy, NARloy-Z (Cu-3Ag-0.1Zr). It provides a benchmark against which to compare the properties of candidate successors. The thermomechanical properties of GRCop-84 have been shown to be superior, and its physical properties comparable, to those of NARloy-Z. However, environmental durability issues control longevity in this application: because copper oxide scales are not highly protective, most copper alloys are quickly consumed in oxygen environments at elevated temperatures. In consequence, NARloy-Z and most other copper alloys are prone to blanching, a degradation process that occurs through cycles of oxidation-reduction as the oxide is repeatedly formed and removed because of microscale fluctuations in the oxygen-hydrogen fuel systems of rocket engines. The Space Shuttle Main Engine lining typically degraded by blanching-induced hot spots that lead to surface roughening, pore formation, and coolant leakage. Therefore, resistance to oxidation and blanching are key requirements for second-generation reusable launch vehicle liners. The rocket engine ambient includes H₂ (fuel) and H₂O (combustion product) and is, hence, under reduced oxygen partial pressures. Accordingly, our studies were expanded to include oxygen partial pressures as low as 322 parts per million (ppm) at the temperatures likely to be experienced in service. A comparison of 10-hr weight gains of GRCop-84, NARloy-Z, and pure copper in 0.032, 2.2, and 100 percent oxygen from 550 to 750 C is shown. In 2.2 vol% and higher oxygen content, GRCop-84 oxidation was slower than that of NARloy-Z or Cu, but that advantage was lost or diminished in 322-ppm O₂. Over longer (50-hr) exposures in 1.0 atm O₂, however, the advantage of GRCop-84 increased significantly, its oxidation rate becoming approximately 10 times slower than those of Cu and NARloy-Z from 500 to 700 C. Weight gains were moderate and the kinetics parabolic for all three materials in 2.2 vol% and higher oxygen content; however, in 322-ppm O₂, the scales were nonprotective below about 650 C, as reflected in linear kinetics and large weight gains. The superior oxidation resistance of GRCop-84 is likely related to the kinetics of extra oxygen consumption to form the additional oxides of Cr and Nb detected beneath the GRCop-84 oxide layer. While we continue to evaluate the blanching resistance of GRCop-84 in other tests, these oxidation results indicate that GRCop-84 is suitable as a reusable launch vehicle liner, and in applications where it is desired to use a copper alloy but without the risk of oxidative failure. Three bar charts comparing overall specific weight gains by each of the three materials

studied. The top chart is for oxidation in 1.0 atm of oxygen, the middle is for 2.2% oxygen (balance argon), and the bottom is for 0.0322% oxygen. GRCo-84 outperforms the other two materials, showing the least weight gain in nearly all cases. Derived from text

Copper Alloys; Oxidation Resistance; Thermodynamics; Mechanical Properties; Space Transportation

20050201928 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Microalloying on the Microstructures and Mechanical Properties of Directionally Solidified Ni-33(at.%)Al-31Cr-3Mo Eutectic Alloys Investigated

Whittenberger, J. Daniel; Raj, Sai V.; Locci, Ivan E.; Salem, Jonathan A.; Research and Technology 2001; March 2002; 5 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Despite nickel aluminide (NiAl) alloys' attractive combination of oxidation and thermophysical properties, their development as replacements for superalloy airfoils in gas turbine engines has been largely limited by difficulties in developing alloys with an optimum combination of elevated-temperature creep resistance and room-temperature fracture toughness. Alternatively, research has focused on developing directionally solidified NiAl-based in situ eutectic composites composed of NiAl and (Cr,Mo) phases in order to obtain a desirable combination of properties a systematic investigation was undertaken at the NASA Glenn Research Center to examine the effects of small additions of 11 alloying elements (Co, Cu, Fe, Hf, Mn, Nb, Re, Si, Ta, Ti, and Zr) in amounts varying from 0.25 to 1.0 at.% on the elevated-temperature strength and room-temperature fracture toughness of directionally solidified Ni-33Al-31Cr-3Mo eutectic alloy. The alloys were grown at 12.7 mm/hr, where the unalloyed eutectic base alloy exhibited a planar eutectic microstructure. The different microstructures that formed because of these fifth-element additions are included in the table. The additions of these elements even in small amounts resulted in the formation of cellular microstructures, and in some cases, dendrites and third phases were observed. Most of these elemental additions did not improve either the elevated-temperature strength or the room-temperature fracture toughness over that of the base alloy. However, small improvements in the compression strength were observed between 1200 and 1400 K when 0.5 at.% Hf and 0.25 at.% Ti were added to the base alloy. The results of this study suggest that the microalloying of Ni-33Al-31Cr-3Mo will not significantly improve either its elevated-temperature strength or its room-temperature fracture toughness. Thus, any improvements in these properties must be acquired by changing the processing conditions.

Derived from text

Nickel Aluminides; Eutectic Alloys; Alloying; Microstructure; Mechanical Properties

20050201929 The Energy Industries of Ohio, Inc., Independence, OH, Independence, OH, USA

Boiler Materials for Ultrasupercritical Coal Power Plants

Viswanathan, R.; Apr. 2002; 40 pp.; In English

Report No.(s): DE2005-833941; No Copyright; Avail: Department of Energy Information Bridge

The principal objective of this project is to develop materials technology for use in ultrasupercritical (USC) plant boilers capable of operating with 760 degrees C (1400 degrees F), and up to 5500 psi with emphasis upon 35 MPa (5000 psi) steam. In the 21st century, the world faces the critical challenge of providing abundant, cheap electricity to meet the needs of a growing global population while at the same time preserving environmental values. Most studies of this issue conclude that a robust portfolio of generation technologies and fuels should be developed to assure that the USA will have adequate electricity supplies in a variety of possible future scenarios. The use of coal for electricity generation poses a unique set of challenges. On the one hand, coal is plentiful and available at low cost in much of the world, notably in the U.S., China, and India. Countries with large coal reserves will want to develop them to foster economic growth and energy security. On the other hand, traditional methods of coal combustion emit pollutants and CO(sub 2) at high levels relative to other generation options. Maintaining coal as a generation option in the 21st century will require methods for addressing these environmental issues.

NTIS

Boilers; Coal; Electric Generators; Energy Conservation

20050201938 Lawrence Livermore National Lab., Livermore, CA USA

Dislocation Interactions with Voids and Helium Bubbles in FCC Metals

Young, J. A.; Wirth, B. D.; Robach, J.; Robertson, I. M.; Dec. 02, 2003; 12 pp.; In English

Report No.(s): DE2005-15013841; UCRL-CONF-201086; No Copyright; Avail: Department of Energy Information Bridge

The formation of a high number density of helium bubbles in FCC metals irradiated within the fusion energy environment

is well established. Yet, the role of helium bubbles in radiation hardening and mechanical property degradation of these steels remains an outstanding issue. In this paper, we present the results of a combined molecular dynamics simulation and in-situ straining transmission electron microscopy study, which investigates the interaction mechanisms between glissile dislocations and nanometer-sized helium bubbles. The molecular dynamics simulations, which directly account for dislocation core effects through semi-empirical interatomic potentials, provide fundamental insight into the effect of helium bubble size and internal gas pressure on the dislocation/bubble interaction and bypass mechanisms. The combination of simulation and in-situ straining experiments provides a powerful approach to determine the atomic to microscopic mechanisms of dislocation-helium bubble interactions, which govern the mechanical response of metals irradiated within the fusion environment.

NTIS

Bubbles; Edge Dislocations; Helium; Metals; Voids

20050202003 Lawrence Livermore National Lab., Livermore, CA USA

Characterization of the Resistance of Alloy 22 to Stress Corrosion Cracking

King, K. J.; Rebak, R. B.; Estill, J. C.; May 30, 2002; 20 pp.; In English

Report No.(s): DE2005-15013493; UCRL-JC-147912; No Copyright; Avail: Department of Energy Information Bridge

In its current design, the high-level nuclear waste containers include an external layer of Alloy 22. Since over their lifetime, the containers may be exposed to multi-ionic aqueous environments, a potential degradation mode of the outer layer could be environmentally assisted cracking (EAC). The objective of the current research was to characterize the effect of applied potential and temperature on the susceptibility of Alloy 22 to EAC in simulated concentrated water (SCW) using the slow strain rate test (SSRT). Results show that Alloy 22 may suffer EAC at applied potentials approximately 400 mV more anodic than the corrosion potential.

NTIS

Corrosion Resistance; Stress Corrosion Cracking

20050202079 NASA Glenn Research Center, Cleveland, OH, USA, Toledo Univ., OH, USA

Self-Tuning Impact Dampers Designed for Turbomachinery Blade Vibration Suppression

Duffy, Kirsten P.; Mehmed, Oral; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Turbomachinery blades are subject to aerodynamic forces that can lead to high-cycle-fatigue (HCF) failures. These failures will only increase as engineers begin to design blades without shrouds or as integrally bladed disks (blisks). These new designs will decrease blade damping significantly because the mechanical damping from shroud and blade joints will be eliminated. Also, it is difficult to design dampers for the engine environment with its extremely high centrifugal loads and high temperatures. The self-tuning impact damper has been designed to provide the additional damping required to avoid HCF while withstanding the harsh engine environment. In addition, the damper is placed within the engine blade itself rather than external to it.

Derived from text

Turbomachinery; Blades; Aerodynamic Forces; Failure

20050203647 QSS Group, Inc., Cleveland, OH, USA

Brazing of Stainless Steels to Yttria Stabilized Zirconia (YSZ) Using Silver -Base Brazes

Singh, Mrityunjay; Shpargel, Tarah P.; Asthana, Rajiv; [2005]; 1 pp.; In English; 29th International Conference on Advanced Ceramics and Composites, 23-28 Jan. 2005, Cocoa Beach, FL, USA

Contract(s)/Grant(s): NAS3-00145; No Copyright; Avail: Other Sources; Abstract Only

Three silver-base brazes containing either noble metal palladium (Palcusil-10 and Palcusil-15) or active metal titanium (Ticusil) were evaluated for high-temperature oxidation resistance, and their effectiveness in joining yttria stabilized zirconia (YSZ) to a corrosion-resistant ferritic stainless steel. Thermogravimetric analysis (TGA), and optical- and scanning electron microscopy (SEM) coupled with energy dispersive spectrometry (EDS) were used to evaluate the braze oxidation behavior and the structure and chemistry of the YSZ/braze/steel joints. The effect of the braze type and processing conditions on the interfacial microstructure and composition of the joint regions is discussed with reference to the chemical changes that occur at the interface. It was found that chemical interdiffusion of the constituents of YSZ, steel and the brazes led to compositional changes and/or interface reconstruction, and metallurgically sound joints.

Author

Brazing; Silver; Stainless Steels; Yttria-Stabilized Zirconia

20050203655 QSS Group, Inc., Cleveland, OH, USA

Reactive Brazing of Carbon-Carbon Composites to Titanium

Shpargel, Tarah; Singh, M.; Morscher, Gregory; Asthana, Rajiv; [2004]; 9 pp.; In English; 5th International Conference on High Temperature Ceramic Matrix Composites, 25-30 Jan. 2005, Cocoa Beach, FL, USA

Contract(s)/Grant(s): NAS3-00145; Copyright; Avail: CASI; A02, Hardcopy

The Ti-metal/C-C composite joints were formed by reactive brazing with three commercial brazes, namely, Cu-ABA, TiCuNi, and TiCuSi. The joint microstructures were examined using optical microscopy, and scanning electron microscopy (SEM) coupled with energy dispersive spectrometry (EDS). The results of the microstructure analysis indicate solute redistribution across the joint and possible metallurgical bond formation via interdiffusion, which led to good wetting and spreading.

Author

Brazing; Carbon-Carbon Composites; Titanium; Alloys; Metallurgy

20050203702 NASA Glenn Research Center, Cleveland, OH, USA

Initial Mechanical Testing of Superalloy Lattice Block Structures Conducted

Krause, David L.; Whittenberger, J. Daniel; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The first mechanical tests of superalloy lattice block structures produced promising results for this exciting new lightweight material system. The testing was performed in-house at NASA Glenn Research Center's Structural Benchmark Test Facility, where small subelement-sized compression and beam specimens were loaded to observe elastic and plastic behavior, component strength levels, and fatigue resistance for hundreds of thousands of load cycles. Current lattice block construction produces a flat panel composed of thin ligaments arranged in a three-dimensional triangulated trusslike structure. Investment casting of lattice block panels has been developed and greatly expands opportunities for using this unique architecture in today's high-performance structures. In addition, advances made in NASA's Ultra-Efficient Engine Technology Program have extended the lattice block concept to superalloy materials. After a series of casting iterations, the nickel-based superalloy Inconel 718 (IN 718, Inco Alloys International, Inc., Huntington, WV) was successfully cast into lattice block panels; this combination offers light weight combined with high strength, high stiffness, and elevated-temperature durability. For tests to evaluate casting quality and configuration merit, small structural compression and bend test specimens were machined from the 5- by 12- by 0.5-in. panels. Linear elastic finite element analyses were completed for several specimen layouts to predict material stresses and deflections under proposed test conditions. The structural specimens were then subjected to room-temperature static and cyclic loads in Glenn's Life Prediction Branch's material test machine. Surprisingly, the test results exceeded analytical predictions: plastic strains greater than 5 percent were obtained, and fatigue lives did not depreciate relative to the base material. These assets were due to the formation of plastic hinges and the redundancies inherent in lattice block construction, which were not considered in the simplified computer models. The fatigue testing proved the value of redundancies since specimen strength was maintained even after the fracture of one or two ligaments. This ongoing test program is planned to continue through high-temperature testing. Also scheduled for testing are IN 718 lattice block panels with integral face sheets, as well as specimens cast from a higher temperature alloy. The initial testing suggests the value of this technology for large panels under low and moderate pressure loadings and for high-risk, damage-tolerant structures. Potential aeropropulsion uses for lattice blocks include turbine-engine actuated panels, exhaust nozzle flaps, and side panel structures.

Author

Heat Resistant Alloys; Mechanical Properties; Crystal Lattices; Structural Members

20050203797 NASA Glenn Research Center, Cleveland, OH, USA, Johns Hopkins Univ., Baltimore, MD, USA

Microsample Characterization of Coatings for GRCop-84 for High Temperature High Heat Flux Application

Jain, Piyush; Hemker, Kevin J.; Raj, Sai V.; [2004]; 1 pp.; In English; Materials Science and Technology 2004 Conference (MS&T 2004), 26-29 Sep. 2004, New Orleans, LA, USA; Copyright; Avail: Other Sources; Abstract Only

NASA's Glenn Research Center has developed GRCop-84 (Cu-8at.%Cr-4% Nb), a high conductivity, high strength copper alloy for use as liners in rocket engine combustion chambers, nozzle ramps and other actively-cooled components subject to high heat fluxes. Two metallic coatings, NiCrAlY and Cu-26%Cr, are being considered for preventing blanching, reducing 'dog-house' failures and providing better environmental resistance to the GRCop-84 liners. This presentation will outline a study of coating-substrate interactions that occur as a result of thermal cycling and coating specific properties at different temperatures. A furnace has been built to thermally cycle the samples under argon. The microsample testing approach is being used to measure the coating-substrate interfacial strength. Cu-26Cr/GRCop-84 samples did not show any obvious

interdiffusion after 300 thermal cycles. Interfacial strength tests of these samples were affected by porosity present in the samples. A complete set of observations and results for Cu-26Cr and NiCrAlY coatings will be presented.

Author

Copper Alloys; Heat Flux; High Strength Alloys; High Temperature; Metal Coatings

20050203798 NASA Glenn Research Center, Cleveland, OH, USA

Compression and Tensile Creep of Binary NiAl

Raj, Sai V.; [2005]; 1 pp.; In English; 2005 TMS Annual Meeting, 13-17 Feb. 2005, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Compression creep and long term tensile creep studies were conducted on cast and extruded binary NiAl in the temperature range 700-1200 K with the objectives of characterizing and understanding the creep mechanisms. Inverse and normal primary creep curves were observed in both compression and tension creep depending on stress and temperature although an asymmetrical response was observed under these two stress states. It was concluded that the primary creep of NiAl is limited by dislocation mobility. The stress exponents, n , for compression and tensile creep were similar varying between about 5 and 14. However, there were significant differences in the stress dependence of the activation energies for compression and tensile creep. The true activation energy for tensile creep, $Q(\text{sub } c)$, was constant and equal to about 400 kJ/mol between 20 and 50 MPa but decreased to a constant value of 250 kJ/mol between 50 and 110 MPa. The activation energy was observed to be inversely stress dependent above 110 MPa. In contrast, $Q(\text{sub } c) = 300$ kJ/mol for compression creep was constant between 25 and 70 MPa and inversely dependent on the true stress above 70 MPa. A detailed discussion of the probable dislocation creep mechanisms governing compressive and tensile creep of NiAl is presented. It is concluded that the non-conservative motion of jogs on screw dislocations influenced the nature of the primary creep curves, where the climb of these jogs involves either the next nearest neighbor or the six-jump cycle vacancy diffusion mechanism. The probable natures of the atom-vacancy exchange that occur within the core of an edge dislocation undergoing climb in NiAl are schematically examined.

Author

Nickel Aluminides; Tensile Creep; Creep Properties; Compressibility; Mobility; Activation Energy

20050203882 NASA Glenn Research Center, Cleveland, OH, USA

Deformation, Failure, and Fatigue Life of SiC/Ti-15-3 Laminates Accurately Predicted by MAC/GMC

Bednarczyk, Brett A.; Arnold, Steven M.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA Glenn Research Center's Micromechanics Analysis Code with Generalized Method of Cells (MAC/GMC) (ref.1) has been extended to enable fully coupled macro-micro deformation, failure, and fatigue life predictions for advanced metal matrix, ceramic matrix, and polymer matrix composites. Because of the multiaxial nature of the code's underlying micromechanics model, GMC--which allows the incorporation of complex local inelastic constitutive models--MAC/GMC finds its most important application in metal matrix composites, like the SiC/Ti-15-3 composite examined here. Furthermore, since GMC predicts the microscale fields within each constituent of the composite material, submodels for local effects such as fiber breakage, interfacial debonding, and matrix fatigue damage can and have been built into MAC/GMC. The present application of MAC/GMC highlights the combination of these features, which has enabled the accurate modeling of the deformation, failure, and life of titanium matrix composites.

Derived from text

Deformation; Failure; Fatigue Life; Silicon Carbides; Titanium

20050203981 NASA Marshall Space Flight Center, Huntsville, AL, USA, Mississippi State Univ., Mississippi State, MS, USA

Quantifying the Material Processing Conditions for an Optimized FSW Process

Schneider, Judy; Nunes, Arthur C., Jr.; [2005]; 1 pp.; In English; American Society for Metals 7th International Trends in Welding Research Conference, 16-20 May 2005, Pine Mountain, GA, USA

Contract(s)/Grant(s): NNM04AA14A; Copyright; Avail: Other Sources; Abstract Only

In friction stir welding (FSW), a rotating threaded pin tool is inserted into a weld seam and literally stirs the edges of the seam together. This environmentally friendly, solid-state technique has been successfully used in the joining of materials that are difficult to fusion weld. To determine optimal processing parameters for producing a defect free weld, a better understanding of the resulting metal deformation flow path and velocity is required. In this study the metal flow fields are

marked by the use of thin (0.001 in. tungsten) wires embedded in the weld seam at various locations. X-ray radiographs record the position and segmentation of the wire and are used to elucidate the flow field. Microstructures observed in a FSW cross-section in an aluminum alloy are related to their respective strain-strain rate-temperature histories along their respective flow trajectories. Two kinds of trajectories, each subjecting the weld metal to a distinct thermomechanical process and imparting a distinct microstructure, can be differentiated within the weld structure.

Author

Friction Stir Welding; Flow Velocity; Flow Distribution; Radiography; X Rays; Tungsten; Strain Rate

27

NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20050199471 NASA Glenn Research Center, Cleveland, OH, USA, DYNACS Engineering Co., Inc., USA

Affordable, Robust Ceramic Joining Technology (ARCJoint) Developed

Steele, Gynelle C.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Affordable, Robust Ceramic Joining Technology (ARCJoint) is a method for joining high temperature-resistant ceramic pieces together, establishing joints that are strong, and allowing joining to be done in the field. This new way of joining allows complex shapes to be formed by joining together geometrically simple shapes. The joining technology at NASA is one of the enabling technologies for the application of silicon-carbide-based ceramic and composite components in demanding and high-temperature applications. The technology is being developed and tested for high-temperature propulsion parts for aerospace use. Commercially, it can be used for joining ceramic pieces used for high temperature applications in the power-generating and chemical industries, as well as in the microelectronics industry. This innovation could yield big payoffs for not only the power-generating industry but also the Silicon Valley chipmakers. This technology, which was developed at the NASA Glenn Research Center by Dr. Mrityunjay Singh, is a two-step process involving first using a paste to join together ceramic pieces and bonding them by heating the joint to 110 to 120 C for between 10 and 20 min. This makes the joint strong enough to be handled for the final joining. Then, a silicon-based substance is applied to the joint and heated to 1400 C for 10 to 15 min. The resulting joint is as strong as the original ceramic material and can withstand the same high temperatures.

Author

Ceramic Bonding; Composite Materials; Silicon Carbides; Technology Assessment

20050199671 Michigan Technological Univ., Houghton, MI, USA

Improvement of Wear Component's Performance by Utilizing Advanced Materials and New Manufacturing Technologies: Castcon Process for Mining Applications. Quarterly Technical Progress Report. For the Period Starting April 1, 2003 ending June 30, 2003

Huang, X.; Gertsch, R.; Mar. 18, 2004; 10 pp.; In English

Report No.(s): DE2005-837256; No Copyright; Avail: Department of Energy Information Bridge

During this reporting period, we mainly focused on solving the disc distortion problem that was encountered in the last quarter. A slower heating rate during off-gassing was tested to reduce the HIPping can expansion. However, slight expansion still occurred. Two 6.5 inch discs were produced with many defects. One was made of H13 powder only and the other was made of H13 powder with WC inserts. It was believed that the defects were caused by the slight expansion of the HIP can during the elevated temperature off-gassing and a vacuum leak in the HIPping can.

NTIS

Cutters; Manufacturing; Mining; Tungsten Carbides; Wear

20050199752 NASA Glenn Research Center, Cleveland, OH, USA

Major Effects of Nonmetallic Inclusions on the Fatigue Life of Disk Superalloy Demonstrated

Gabb, Timothy P.; Telesman, Jack; Kantzos, Peter T.; Bonacuse, Peter J.; Barrie, Robert L.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The fatigue properties of modern powder metallurgy disk alloys can vary because of the different steps of materials and component processing and machining. Among these variables, the effects of nonmetallic inclusions introduced during the powder atomization and handling processes have been shown to significantly degrade low-cycle fatigue life. The levels of

inclusion contamination have, therefore, been reduced to less than 1 part per million in state-of-the-art nickel disk powder-processing facilities. Yet the large quantities of compressor and turbine disks weighing from 100 to over 1000 lb have enough total volume and surface area for these rare inclusions to still be present and limit fatigue life. The objective of this study was to investigate the effects on fatigue life of these inclusions, as part of the Crack Resistant Disk Materials task within the Ultra Safe Propulsion Project. Inclusions were carefully introduced at elevated levels in a nickel-base disk superalloy, U720, produced using powder metallurgy processing. Multiple strain-controlled fatigue tests were then performed on extracted test specimens at 650 C. Analyses were performed to compare the low-cycle fatigue lives and failure initiation sites as functions of inclusion content and fatigue conditions. Powder of the nickel-base superalloy U720 was atomized in argon at Special Metals Corporation, Inc., using production-scale high-cleanliness powder-processing facilities and handling practices. The powder was then passed through a 270-mesh screen. One portion of this powder was set aside for subsequent consolidation without introduced inclusions. Two other portions of this powder were seeded with alumina inclusions. Small, polycrystalline soft (Type 2) inclusions of about 50 μm diameter were carefully prepared and blended into one powder lot, and larger hard (Type 1) inclusions of about 150 μm mean diameter were introduced into the other seeded portion of powder. All three portions of powder were then sealed in separate containers, hot isostatically pressurized, extruded, forged into subscale disks, and heat treated. Low-cycle-fatigue specimens were then extracted, machined, and tested. Fatigue tests were performed at 650 C in closed-loop servohydraulic testing machines using induction heating and axial extensometers. All tests were continued to failure, and fractographic evaluations were performed on all specimens to determine the crack initiation sites. A large majority of the failures in specimens with introduced inclusions occurred at cracks initiating from inclusions at the specimen surface, as shown for each type of inclusion in the following bar chart. The inclusions significantly reduced fatigue life from unseeded material levels, as shown in the bar chart. These effects were found to depend on the strain range, strain ratio, and inclusion size. Tests at lower strain ranges and higher strain ratios resulted in larger effects of inclusions on life. Inclusion effects on life were thereby maximized in tests at the lowest strain range of 0.6 percent and the most positive strain ratio of 0.5. Under these conditions, small Type 2 inclusions reduced life substantially-- about 20 times, whereas large Type 1 inclusions dramatically reduced life 100 times. These results clearly demonstrate that it is essential to include the effects of inclusions for realistic predictions of disk fatigue life. Important issues, including temperature dependence, crack initiation versus propagation, surface treatments, realistic disk features and machining, and realistic disk spin testing will be addressed to accurately model inclusion effects on disk fatigue life. Fatigue life varied from well over 10⁵ cycles for no inclusions to a little over 10³ cycles for 100-micrometer inclusions. A single crack initiating at a surface-connected seeded inclusion caused failure in each case.

Author

Heat Resistant Alloys; Inclusions; Powder Metallurgy; Fatigue Life

20050200951 Army Engineer Research and Development Center, Vicksburg, MS USA

Laboratory Characterization of Fine Aggregate Cementitious Material

Williams, Erin M.; Akers, Stephen A.; Reed, Paul A.; Jul. 2005; 101 pp.; In English; Original contains color illustrations Report No.(s): AD-A435634; ERDC/GSL-TR-05-16; No Copyright; Avail: Defense Technical Information Center (DTIC)

Personnel of the Geotechnical and Structures Laboratory, U.S. Army Engineer Research and Development Center, conducted a laboratory investigation to characterize the strength and constitutive property behavior of a fine aggregate cemented material (FACM). The FACM was designed to have a 34-MPa (5,000-psi) unconfined strength and to contain no coarse aggregate. Forty-three mechanical property tests two hydrostatic compression tests (HC), four unconfined compression tests (UC), 16 triaxial compression tests (TXC), two uniaxial strain tests (UX), four uniaxial strain load/biaxial strain unloading tests (UX/BX), three uniaxial strain load/constant volume tests (UX/CV), three uniaxial strain load/constant strain path tests (UX/SP), five direct pull tests (DP), one conventional triaxial extension test (CTE), and three reduced triaxial extension tests (RTE)_were successfully completed. In addition to the mechanical property tests, nondestructive pulse-velocity measurements were performed on each specimen. The TXC tests exhibited a continuous increase in principal stress difference with increasing confining stress. A recommended compression failure surface was developed from the TXC and UC test results. Test data from the RTE, CTE, and DP tests were used to develop a recommended extension failure surface for FACM. Results from the stress paths of the strain path tests and the recommended compression failure surface exhibited good agreement.

DTIC

Aggregates; Cements; Triaxial Stresses

20050200964 Wavelet Technologies, Inc., Attleboro, MA USA

Electromagnetic Design Techniques Enabling Control of the RFID Supply Chain

Hohlfeld, Robert G.; Jul. 2005; 28 pp.; In English

Contract(s)/Grant(s): N00014-05-M-03

Report No.(s): AD-A435652; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report summarizes progress in the SBIR Phase I project 'Electromagnetic Design Techniques Enabling Control of the RFID Supply Chain'. During this project Wavelet Technologies, Inc. (WTI) has extended its genetic optimization program to include a variety of additional antenna geometries, worked out means for translating antenna designs to a form suitable for prototype fabrication, acquired RFID chips sufficient to demonstrate component independence, produced and tested genetically optimized RFID tag designs, obtained equipment and made modifications to its laboratory for prototype tag fabrication, and constructed software for Monte Carlo studies of its business case model. The following section describes the status of each of the Phase I tasks in turn. For tasks in which technical work was completed in earlier reporting periods, the reader will be referred to the appropriate reports for the detailed technical descriptions of the work accomplished under that task.

DTIC

Antenna Components; Electromagnetic Properties; Electromagnets; Radio Frequencies; Transponders

20050201055 Army Defense Ammunition Center, McAlester, OK USA

Transportability Testing of the Joint Direct Attack Munition (JDAM) Packed in a CNU-589 Shipping and Storage Container Using Vinyl Dunnage Air Bags, TP-94-01, Revision 2, June 2004, 'Transportability Testing Procedures'

May 2005; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435810; REPT-05-12; No Copyright; Avail: Defense Technical Information Center (DTIC)

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAG-DEV), was tasked by Naval Surface Warfare Center to conduct transportability testing on the Joint Direct Attack Munition (JDAM) packed in CNU-589 shipping and storage containers when secured using vinyl air bags as dunnage. The air bags were manufactured by Centerload Shipping Technologies, Hayward, CA. Polyester strapping was used to secure the JDAM CNU-589 containers in a stack. The polyester strapping was manufactured by Polychem Corporation, Mentor, OH. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 'Transportability Testing Procedures.' The testing included Hazard Course, Road Trip, and Panic Stops. The objectives of the testing were to evaluate the use of vinyl air bags as dunnage and to evaluate the use of polyester strapping for shipping the JDAM CNU-589 containers by commercial trailers. The interface between the vinyl air bags and steel strapping was also evaluated.

DTIC

Air Bag Restraint Devices; Ammunition

20050201058 Operational Technologies Corp., Beavercreek, OH USA

Lessons Learned Using Fractions to Assess Risk at Petroleum Release Sites

Reed, Dennis A.; Sterner, Teresa R.; Apr. 2004; 50 pp.; In English

Contract(s)/Grant(s): F41624-94-D-9003-008; Proj-1710

Report No.(s): AD-A435822; AFRL-HE-WP-TR-2004-0126; No Copyright; Avail: CASI; [A03](#), Hardcopy

Total petroleum hydrocarbon (TPH) fractional analysis and tiered risk assessments at petroleum release sites are replacing cleanup approaches based upon total TPH concentrations. Field demonstrations of the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) approach for assessing human health risk at petroleum release sites were performed at eight Department of Defense installations. One site also provided an opportunity to demonstrate the Massachusetts Department of Environmental Protection methodology and compare the approaches. Two lessons learned from the field demonstrations were: (1) TPH fractional analysis approaches provide a scientific bases for assessing risk and implementing appropriate criteria alone; and (2) the TPHCWG approach should not be used at relatively 'fresh' petroleum product release sites because benzene, a known human carcinogen, is likely to be present at concentrations high enough to dominate cleanup decisions.

DTIC

Cleaning; Crude Oil; Hydrocarbons; Risk

20050201061 Chicago Univ., Chicago, IL USA

Searching for Better Photorefractive Materials

Yu, Luping; Jul. 2005; 48 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0218

Report No.(s): AD-A435831; AFRL-SR-AR-TR-05-0310; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report summarizes the research effort for the grant period as indicated above on search for better photorefractive materials. New synthetic approaches and new materials with much improved photorefractive properties have been developed. Detailed discussion and description are described in this report. It was also reported the development of conjugated diblock co-oligomers for rectifying effect, which is the fundamental requirement for photovoltaic applications.

DTIC

Conjugation; Copolymers; Oligomers; Photovoltaic Effect

20050201102 National Renewable Energy Lab., Golden, CO USA

Biomass Oil Analysis: Research Needs and Recommendations

Tyson, K. S.; Bozell, Joseph; Wallace, Robert; Petersen, Eugene; Moens, Luc; Jun. 2004; 116 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC39-99-GO10337

Report No.(s): AD-A435922; NREL/TP-510-34796; No Copyright; Avail: Defense Technical Information Center (DTIC)

Report analyzing the use of biomass oils to help meet Office of the Biomass Program goals of establishing commercial biorefinery by 2010 and commercializing at least four biobased products.

DTIC

Biomass; Oils

20050201118 California Univ., Santa Barbara, CA USA

Structure of Hybrid Polyhedral Oligomeric Silsesquioxane Polymethacrylate Oligomers Using Ion Mobility Mass Spectrometry and Molecular Mechanics

Andersona, Stanley E.; Baker, Erin S.; Mitchell, Connie; Haddad, Timothy S.; Bowers, Michael T.; Dec. 2004; 27 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A435975; No Copyright; Avail: Defense Technical Information Center (DTIC)

Ion mobility and molecular modeling methods were used to examine the gas phase conformational properties of POSS (Polyhedral Oligomeric Silsesquioxanes) propylmethacrylate (PMA) oligomers. MALDI was utilized to generate sodiated (PMA) $\text{Cp}7\text{T}8\text{xNa}^+$ ions, and their collision cross-sections were measured in helium using ion mobility based methods. Results for $x = 1, 2$, and 3 were consistent with only one conformer occurring for the $\text{Na}+1$ -mer and $\text{Na}+3$ -mer, but two or more conformers are present for the $\text{Na}+2$ -mer. Theoretical modeling of the $\text{Na}+1$ -mer using the AMBER suite of programs indicates only one family of low-energy structures is found, in which the sodium ion binds to the carbonyl oxygen on the PMA and 4 oxygens on one face of the POSS cage. The calculated cross-section of this family agrees very well with the experimental value, with 2% deviation. For the $\text{Na}+2$ -mer, theory predicts three separate conformer families based on whether the backbone attachments to the two POSS cages are 'cis' (larger) or 'extended trans' or 'trans' (smaller). The calculated cross-sections agree very well with the two experimental values. For the $\text{Na}+3$ -mer, theory predicts a 'syndiotactic' family of structures at lowest energy whose average cross-section is consistent with the experimental cross-section. Modeling shows the different conformer families are primarily due to non-bonded interactions of the capping Cp groups which stabilize POSS cage packing in a variety of ways.

DTIC

Mass Spectroscopy; Mobility; Oligomers; Polymers

20050201121 Massachusetts Inst. of Tech., Cambridge, MA USA

Characterization of the Phase Transitions of Ethyl Substituted Polyhedral Oligomeric Silsesquioxane

Poliskie, G. M.; Haddad, T. S.; Blanski, R. L.; Gleason, K. K.; Feb. 2005; 28 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0447; Proj-2303

Report No.(s): AD-A435983; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study describes the synthesis and molecular mobility of both partially deuterated and fully protonated ethyl polyhedral oligomeric silsesquioxane (POSS) crystals. Phase transitions were identified with differential scanning calorimetry at 258 K and 253 K for partially deuterated and fully protonated ethyl POSS, respectively. A change in entropy of 20.8 K was observed for both transitions. The crystallographic phase transitions were identified as a high temperature rhombohedral unit cell with a contraction in volume and symmetry described by a low temperature triclinic unit cell past the transition temperature. Abrupt changes in the spin lattice relaxation and linewidth were detected with solid state proton nuclear magnetic resonance (NMR) spectroscopy, at the same temperatures detected with calorimetry. This NMR behavior suggests a transition

in molecular motions of both ethyl derivatives. For deuterated ethyl POSS, the motions become increasingly anisotropic after the temperature is lowered past its transition point. Both derivatives exhibit an increase in the correlation time (~ 2 ns to ~ 15 ns) and activation energy (~ 16 kJ/mol to ~ 20 kJ/mol) for molecular tumbling at temperatures past their respective transitions.

DTIC

Ethyl Compounds; Phase Transformations; Polymers

20050201596 Department of the Navy, Washington, DC USA

High Strain Piezo-Polymer

Ramotowski, Thomas S., Inventor; Kavarnos, George J., Inventor; Zhang, Qiming, Inventor; Jul. 2005; 24 pp.; In English Report No.(s): AD-D020211; No Copyright; Avail: CASI; [A03](#), Hardcopy

A primary objective of the present invention is to produce an electrostrictive terpolymer such as vinylidene fluoride-trifluoroethylene-chlorofluoroethylene (VDF-TrFE-CFE), without utilizing electron irradiation, which may be used as an active material capable of generating sound in acoustic, underwater transducers and mechanical motion in actuator devices. It is also a primary objective of the present invention to produce an electrostrictive terpolymer such as VDF-TrFE-CFE which may be used as a replacement for electron irradiated high-strain P(VDF-TrFE) films. It is also a primary objective of the present invention to produce an electrostrictive terpolymer such as VDF-TrFE-CFE which has gauche-type conformational defects along the polymer chain which results in a broad distribution of polarizations that favor higher electrostrictive strains than current electrostrictive polymers. It is also an objective of the present invention to produce an electrostrictive terpolymer which exhibits larger mechanical strains than known in the art. It is also an objective of the present invention to process an electrostrictive terpolymer such as VDF-TrFE-CFE which is less expensive and less cumbersome than current electrostrictive materials and methods of making those electrostrictive materials.

DTIC

Electrostriction; High Polymers; Patent Applications; Piezoelectricity; Polymers

20050201791 NASA Glenn Research Center, Cleveland, OH, USA

Sensitive Technique Developed Using Atomic Force Microscopy to Measure the Low-Earth-Orbit Atomic Oxygen Erosion of Polymers

deGroh, Kim D.; Banks, Bruce A.; Clark, Gregory W.; Hammerstrom, Anne; Youngstrom, Erica; Kaminski, Carolyn; Fine, Elizabeth; Marx, Laura; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A recession measurement technique has been developed at the NASA Glenn Research Center to determine the atomic oxygen durability of polymers exposed to the space environment for short durations. Polymers such as polyimide Kapton and Teflon FEP (fluorinated ethylene propylene, DuPont) are commonly used in spacecraft because of their desirable properties, such as flexibility, low density, and in the case of FEP, low solar absorptance and high thermal emittance. Polymers on the exterior of spacecraft in the low-Earth-orbit environment are exposed to energetic atomic oxygen, resulting in erosion and potential structural loss. It is, therefore, important to understand the atomic oxygen erosion yield (E, the volume loss per incident oxygen atom) of polymers being considered in spacecraft design. Because long-term space exposure data are rare and very costly, short-term exposures, such as on the space shuttles, are often relied on for atomic oxygen erosion determination. The most common technique for determining E is through mass-loss measurements. For limited-duration exposure experiments, such as shuttle flight experiments, the atomic oxygen fluence is often so small that mass-loss measurements are not sensitive enough. Therefore, a recession measurement technique has been developed at Glenn to obtain accurate erosion yields of polymers exposed to low atomic oxygen fluences.

Derived from text

Exposure; Losses; Low Earth Orbits; Oxygen Atoms; Polyimides; Thermal Emission

20050201881 NASA Glenn Research Center, Cleveland, OH, USA

Environment-Conscious Ceramics (Ecoceramics) Technology Received 2001 R&D 100 Award

Singh, Mrityunjay; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Since the dawn of human civilization, there has been a delicate balance between the use of resources as human frontiers expanded and the need to have a minimum influence on the ecosystem. The first 200 years of the industrial revolution essentially solved the problem of production. However, the massive production of goods also generated tremendous amounts

of byproducts and wastes. In the new millennium, to sustain a healthy life in harmony with nature, it will be extremely important for us to develop various materials, products, and processes that minimize any harmful influence on the environment. Environment-conscious ceramics (ecoceramics) are a new class of materials that can be fabricated with renewable resources (wood) and wood waste material (wood sawdust). Wood is a 'lignocellulosic' material formed by the photosynthetic reaction within the needles or leaves of trees. The photosynthesis process uses sunlight to take carbon dioxide from air and convert it into oxygen and organic materials. Wood has been known to be one of the best and most intricate engineering materials created by nature and known to mankind. In addition, natural woods of various types are available throughout the world. On the other hand, wood sawdusts are generated in abundant quantities by sawmills. Environment-conscious ceramic materials, fabricated via the pyrolysis and infiltration of natural wood-derived preforms, have tailorable properties with numerous potential applications. The experimental studies conducted to date on the development of materials based on biologically derived structures indicate that these materials behave like ceramic materials manufactured by conventional approaches. These structures have been shown to be quite useful in producing porous or dense materials having various microstructures and compositions.

Derived from text

Wood; By-Products; Dust; Ceramic Matrix Composites; Recycling; Organic Materials

20050201882 NASA Glenn Research Center, Cleveland, OH, USA

High-Glass-Transition-Temperature Polyimides Developed for Reusable Launch Vehicle Applications

Chuang, Kathy; Ardent, Cory P.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Polyimide composites have been traditionally used for high-temperature applications in aircraft engines at temperatures up to 550 F (288 C) for thousands of hours. However, as NASA shifts its focus toward the development of advanced reusable launch vehicles, there is an urgent need for lightweight polymer composites that can sustain 600 to 800 F (315 to 427 C) for short excursions (hundreds of hours). To meet critical vehicle weight targets, it is essential that one use lightweight, high-temperature polymer matrix composites in propulsion components such as turbopump housings, ducts, engine supports, and struts. Composite materials in reusable launch vehicle components will heat quickly during launch and reentry. Conventional composites, consisting of layers of fabric or fiber-reinforced lamina, would either blister or encounter catastrophic delamination under high heating rates above 300 C. This blistering and delamination are the result of a sudden volume expansion within the composite due to the release of absorbed moisture and gases generated by the degradation of the polymer matrix. Researchers at the NASA Glenn Research Center and the Boeing Company (Long Beach, CA) recently demonstrated a successful approach for preventing this delamination--the use of three-dimensional stitched composites fabricated by resin infusion.

Derived from text

Composite Materials; Delaminating; Fabrication; Fiber Composites; Glass Transition Temperature; Polyimides

20050201887 NASA Glenn Research Center, Cleveland, OH, USA

Effect of Environment on the Stress- Rupture Behavior of a C/SiC Composite Studied

Verrilli, Michael J.; Kiser, J. Douglas; Opila, Elizabeth J.; Calomino, Anthony M.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Advanced reusable launch vehicles will likely incorporate fiber-reinforced ceramic matrix composites (CMC's) in critical propulsion and airframe components. The use of CMC's is highly desirable to save weight, improve reuse capability, and increase performance. One of the candidate CMC materials is carbon-fiber-reinforced silicon carbide (C/SiC). In potential propulsion applications, such as turbopump rotors and nozzle exit ramps, C/SiC components will be subjected to a service cycle that includes mechanical loading under complex, high-pressure environments containing hydrogen, oxygen, and steam. Degradation of both the C fibers and the SiC matrix are possible in these environments. The objective of this effort was to evaluate the mechanical behavior of C/SiC in various environments relevant to reusable launch vehicle applications. Stress-rupture testing was conducted at the NASA Glenn Research Center on C/SiC specimens in air and steam-containing environments. Also, the oxidation kinetics of the carbon fibers that reinforce the composite were monitored by thermogravimetric analysis in the same environments and temperatures used for the stress-rupture tests of the C/SiC composite specimens. The stress-rupture lives obtained for C/SiC tested in air and in steam/argon mixtures are shown in the following bar chart. As is typical for most materials, lives obtained at the lower temperature (600 C) are longer than for the higher temperature (1200 C). The effect of environment was most pronounced at the lower temperature, where the average test duration in steam at 600 C was at least 30 times longer than the lives obtained in air. The 1200 C data revealed little difference

between the lives of specimens tested in air and steam at atmospheric pressure.

Author

Mechanical Properties; Stress Measurement; Thermogravimetry; Ceramic Matrix Composites; Environmental Tests

20050201903 NASA Glenn Research Center, Cleveland, OH, USA, Hathaway Brown School, Shaker Heights, OH, USA
MISSE PEACE Polymers: An International Space Station Environmental Exposure Experiment Being Conducted
deGroh, Kim K.; Banks, Bruce A.; Hammerstrom, Anne; Youngstrom, Erica; Kaminski, Carolyn; Marx, Laura; Fine, Elizabeth; Gummow, Jonathan D.; Wright, Douglas; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

As part of the Materials International Space Station Experiment (MISSE), 41 different polymers are being exposed for approximately 1 1/2 years to the low-Earth-orbit (LEO) environment on the exterior of the International Space Station. MISSE is a materials flight experiment sponsored by the Air Force Research Lab/Materials Lab and NASA, and is the first external experiment on the space station. A similar set of 41 polymers will be flown as part of the Polymer Erosion and Contamination Experiment (PEACE) a shuttle flight experiment that is being developed at the NASA Glenn Research Center collaboratively with the Hathaway Brown School for girls. Therefore, these 41 polymers are collectively called the MISSE PEACE Polymers. The purpose of the MISSE PEACE Polymers experiment is to determine how durable polymers are in the LEO space environment where spacecraft, such as the space station, orbit. Polymers are commonly used as spacecraft materials because of their desirable properties such as good flexibility, low density, and certain electrical properties or optical properties (such as a low solar absorptance and high thermal emittance). Two examples of the use of polymers on the exterior of spacecraft exposed to the space environment include metalized Teflon FEP (fluorinated ethylene propylene, DuPont) thermal control materials on the Hubble Space Telescope, and polyimide Kapton (DuPont) solar array blankets.

Derived from text

Aerospace Environments; Contamination; Durability; Erosion; Ethylene; Thermal Emission

20050201904 NASA Glenn Research Center, Cleveland, OH, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA

Physical and Thermal Properties Evaluated of Teflon FEP Retrieved From the Hubble Space Telescope During Three Servicing Missions

Dever, Joyce A.; deGroh, Kim, K.; Sutter, James K.; Gaier, James R.; Messer, Russell, K.; Scheiman, Daniel A.; McClendon, Mark W.; Viens, Michael J.; Wang, L. Len; He, Charles C.; Gummow, Jonathan D.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Mechanical properties of aluminized Teflon fluorinated ethylene propylene (FEP) thermal control materials on the Hubble Space Telescope (HST) exposed to low Earth orbit for up to 9.7 years have significantly degraded, with extensive cracking occurring on orbit. The NASA Glenn Research Center and the NASA Goddard Space Flight Center have collaborated on analyzing the physical and thermal properties of aluminized FEP (FEP-Al, DuPont) materials retrieved in December 1999 during HST's third servicing mission (SM3A). Comparisons have been made to properties of FEP-Al retrieved during the first and second HST servicing missions, SM1 and SM2, in order to determine degradation processes for FEP on HST.

Derived from text

Teflon (Trademark); Thermodynamic Properties; Degradation; Mechanical Properties

20050203962 Florida Univ., Gainesville, FL, USA

The features of self-assembling organic bilayers important to the formation of anisotropic inorganic materials in microgravity conditions

Talham, Daniel R.; Adair, James H.; [2005]; 8 pp.; In English

Contract(s)/Grant(s): NAG8-1675; No Copyright; Avail: CASI; [A02](#), Hardcopy

Materials with directional properties are opening new horizons in a variety of applications including chemistry, electronics, and optics. Structural, optical, and electrical properties can be greatly augmented by the fabrication of composite materials with anisotropic microstructures or with anisotropic particles uniformly dispersed in an isotropic matrix. Examples include structural composites, magnetic and optical recording media, photographic film, certain metal and ceramic alloys, and display technologies including flat panel displays. The new applications and the need for model particles in scientific investigations are rapidly out-distancing the ability to synthesize anisotropic particles with specific chemistries and narrowly

distributed physical characteristics (e.g. size distribution, shape, and aspect ratio).

Derived from text

Anisotropy; Composite Materials; Microgravity; Organic Materials; Inorganic Materials

20050203973 NASA Glenn Research Center, Cleveland, OH, USA

Epoxy Crosslinked Silica Aerogels (X-Aerogels)

fabrizio, Eve; Ilhan, Faysal; Meador, Mary Ann; Johnston, Chris; Leventis, Nicholas; [2004]; 1 pp.; In English; 227th National American Chemical Society Meeting, 28 Mar. - 1 Apr. 2004, Anaheim, CA, USA

Contract(s)/Grant(s): 22-708-93-11

Report No.(s): Paper 711229; No Copyright; Avail: Other Sources; Abstract Only

NASA is interested in the development of strong lightweight materials for the dual role of thermal insulator and structural component for space vehicles; freeing more weight for useful payloads. Aerogels are very-low density materials (0.010 to 0.5 g/cc) that, due to high porosity (meso- and microporosity), can be, depending on the chemical nature of the network, ideal thermal insulators (thermal conductivity approx. 15 mW/mK). However, aerogels are extremely fragile. For practical application of aerogels, one must increase strength without compromising the physical properties attributed to low density. This has been achieved by templated growth of an epoxy polymer layer that crosslinks the 'pearl necklace' network of nanoparticles: the framework of a typical silica aerogel. The requirement for conformal accumulation of the epoxy crosslinker is reaction both with the surface of silica and with itself. After cross-linking, the strength of a typical aerogel monolith increases by a factor of 200, in the expense of only a 2-fold increase in density. Strength is increased further by coupling residual unreacted epoxides with diamine.

Author

Aerogels; Xerogels; Silica Gel; Crosslinking

20050203985 NASA Glenn Research Center, Cleveland, OH, USA

Corrosion Issues for Ceramics in Gas Turbines

Jacobson, Nathan; Opila, Elizabeth; Nickel, Klaus G.; [2004]; 1 pp.; In English; 28th Annual International Conference and Exposition on Advanced Ceramics and Composites, 25-30 Jan. 2004, Cocoa Beach, FL, USA

Contract(s)/Grant(s): 22-714-30-09; No Copyright; Avail: Other Sources; Abstract Only

The requirements for hot-gas-path materials in gas turbine engines are demanding. These materials must maintain high strength and creep resistance in a particularly aggressive environment. A typical gas turbine environment involves high temperatures, rapid gas flow rates, high pressures, and a complex mixture of aggressive gases. Over the past forty years, a wealth of information on the behavior of ceramic materials in heat engine environments has been obtained. In the first part of the talk we summarize the behavior of monolithic SiC and Si₃N₄. These materials show excellent baseline behavior in clean, oxygen environments. However the aggressive components in a heat engine environment such as water vapor and salt deposits can be quite degrading. In the second part of the talk we discuss SiC-based composites. The critical issue with these materials is oxidation of the fiber coating. We conclude with a brief discussion of future directions in ceramic corrosion research.

Author

Silicon Carbides; Ceramics; Corrosion; High Temperature Environments; Engine Parts; Silicon Nitrides

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PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 *Nuclear Physics*. For related information see also 07 *Aircraft Propulsion and Power*; 20 *Spacecraft Propulsion and Power*; and 44 *Energy Production and Conversion*.

20050200896 Naval Postgraduate School, Monterey, CA USA

Comparison of the Price and Volatility of Current and Alternative Models for the Acquisition of Direct Supply Natural Gas for the Department of Defense

Haycock, Margot; Jun. 2005; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435519; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) is the largest user of energy in the nation. DoD utilizes the Defense Energy Support Center (DESC) to procure a large portion of its natural gas. In this study it will be determined if the current buying approach

utilized by DESC or an alternative approach present a better method to reduce the pricing risks associated with market timing and volatility. In order to determine how market timing and volatility affect purchasing, historical data for actual monthly prices of the current program and data from market pricing indices for a statistical model were analyzed. The data for the current model and the statistical model were compared using averages prices and standard deviation to determine which model provided better overall results. The analysis proved that by entering the market to purchase natural gas more frequently and using firm fixed price contracts results in an overall lower average price with less variability than using the current method of purchasing. This study recommends that DESC consider a pilot program, beginning in the northeast region, where the current purchasing model produces the most volatility in pricing, to develop a procurement program which will support stabilized pricing for its DoD customers.

DTIC

Cost Analysis; Defense Program; Natural Gas; Volatility

20050201060 Operational Technologies Corp., Beavercreek, OH USA

Provisional Reference Dose for the Aromatic Fraction of Jet Fuel: Insight into Complex Mixtures

Sterner, Teresa R.; Vohees, Donna J.; Smith, Peter B.; Green, John B.; Mattie, David R.; Weisman, Wade H.; Apr. 2005; 23 pp.; In English

Contract(s)/Grant(s): F41624-97-C-9013; Proj-1710

Report No.(s): AD-A435824; AFRL-HE-WP-TR-2004-0125; No Copyright; Avail: CASI; [A03](#), Hardcopy

Previous efforts to define toxicity criteria for human health risk assessment of complex petroleum mixtures use health effects information for only a subset of the chemicals in such mixtures. The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) developed a practical alternative by defining all petroleum mixtures as thirteen carbon number range fractions based on expected transport characteristics following release to the environment. The TPHCWG developed toxicity criteria for each fraction using all available data, prioritizing mixture toxicity information. However, limited toxicity data were available to represent the fractions, including the EC₈ - EC₁₆ aromatic fraction, which is believed to be one of the more toxic fractions. To address this data gap, a 90-day oral gavage toxicity study was conducted in female Sprague-Dawley rats and male CS7BL/6 mice to characterize toxic effects of the EC₈ - EC₁₆ aromatic fraction of Jet Fuel A. Animals were dosed at 0, 20, 100 and 500 mg/kg/day.

DTIC

Dosage; Jet Engine Fuels; Toxicity

20050203875 NASA Glenn Research Center, Cleveland, OH, USA

Liquid Oxygen Propellant Densification Unit Ground Tested With a Large-Scale Flight-Weight Tank for the X-33 Reusable Launch Vehicle

Tomsik, Thomas M.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Propellant densification has been identified as a critical technology in the development of single-stage-to-orbit reusable launch vehicles. Technology to create supercooled high-density liquid oxygen (LO₂) and liquid hydrogen (LH₂) is a key means to lowering launch vehicle costs. The densification of cryogenic propellants through subcooling allows 8 to 10 percent more propellant mass to be stored in a given unit volume, thereby improving the launch vehicle's overall performance. This allows for higher propellant mass fractions than would be possible with conventional normal boiling point cryogenic propellants, considering the normal boiling point of LO₂ and LH₂.

Derived from text

Liquid Oxygen; Ground Tests; Reusable Launch Vehicles; Cryogenic Rocket Propellants

20050203888 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Structure of Propagating and Attached Hydrocarbon Flames

Takahashi, Fumiaki; Katta, Viswanath; [2004]; 1 pp.; In English; 2004 Technical Meeting of the Central States Section of the Combustion Institute, 21-23 Mar. 2004, Austin, TX, USA

Contract(s)/Grant(s): NCC3-975; WBS 22-101-58-09; No Copyright; Avail: Other Sources; Abstract Only

Direct numerical simulations with C₃-chemistry and radiative heat-loss models have been performed to reveal the internal structure of propagating and attached flames in an axisymmetric fuel jet of methane, ethane, ethylene, acetylene, or propane in air under normal and zero gravity. Observations of the flames were also made at the NASA Glenn 2.2-Second Drop Tower. In computations, the fuel issued into quasi-quiescent air for a fixed mixing time before it was ignited along the centerline at

stoichiometry. The edge of the flame propagated through a flammable layer at the laminar flame speed of the stoichiometric fuel-air mixture independent of gravity. For all cases, a peak reactivity spot, i.e., reaction kernel, was formed in the flame base, thereby holding a trailing diffusion flame. The location of the reaction kernel in the attached flames depended inversely on the reactivity. The reaction-kernel correlations between the reactivity and the velocity were developed further using variables related to local Damkahler and Peclet numbers.

Author

Flame Propagation; Hydrocarbon Fuels; Methane; Ethane; Ethylene; Acetylene; Propane

20050203889 NASA Glenn Research Center, Cleveland, OH, USA

MEA Failure Mechanisms in PEM Fuel Cells Operated on Hydrogen and Oxygen

Stanic, Vesna; Hoberecht, Mark; [2004]; 1 pp.; In English; 2004 Fuel Cell Seminar, 1-5 Nov. 2004, San Antonio, TX, USA
Contract(s)/Grant(s): NAS3-02203; No Copyright; Avail: CASI; [A01](#), Hardcopy

No abstract available

Failure; Fuel Cells; Hydrogen; Oxygen

20050203921 Edith Cowan Univ., Mount Lawley, Australia

Ballistics Image Visualisation and Processing for an Internet Firearm Identification System

Li, Dong-Guang; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The cartridge case image database for positive firearm identification is a part of the ballistics firearm identification system, Fireball, developed at Edith Cowan University (ECU) for Australian police. Web based tools for querying, visualising and simple image processing the cartridge case image from the database have been developed. This paper will briefly describe this system and give details of these tools. The paper will discuss the application of the imaging technique to online processing, and the potential of the technique for on-line image matching. Web Interface of the Fireball on-line system developed by the Information Visualisation and Soft Computing Lab at ECU will be presented, and analyses of the images will be conducted.

Author

Ballistics; Image Processing; Internets; Scientific Visualization; Gunfire

20050203968 NASA Glenn Research Center, Cleveland, OH, USA

Hydrogen-Oxygen PEM Regenerative Fuel Cell at NASA Glenn Research Center

Bents, David J.; March 08, 2004; 2 pp.; In English; Fuel Cell Seminar, Nov. 2004, San Antonio, TX, USA

Contract(s)/Grant(s): 22-708-02-04; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center has constructed a closed-cycle hydrogen-oxygen PEM regenerative fuel cell (RFC) to explore its potential use as an energy storage device for a high altitude solar electric aircraft. Built up over the last 2 years from specialized hardware and off the shelf components the Glenn RFC is a complete 'brassboard' energy storage system which includes all the equipment required to (1) absorb electrical power from an outside source and store it as pressurized hydrogen and oxygen and (2) make electrical power from the stored gases, saving the product water for re-use during the next cycle. It consists of a dedicated hydrogen-oxygen fuel cell stack and an electrolyzer stack, the interconnecting plumbing and valves, cooling pumps, water transfer pumps, gas recirculation pumps, phase separators, storage tanks for oxygen (O₂) and hydrogen (H₂), heat exchangers, isolation valves, pressure regulators, nitrogen purge provisions, instrumentation, and other components. Its specific developmental functions include: (1) Test fuel cells and fuel cell components under repeated closed-cycle operation (nothing escapes; everything is used over and over again). (2) Simulate diurnal charge-discharge cycles (3) Observe long-term system performance and identify degradation and loss mechanisms. (4) Develop safe and convenient operation and control strategies leading to the successful development of mission-capable, flight-weight RFC's.

Author

Regenerative Fuel Cells; Diurnal Variations; Energy Storage; Fluid Flow; Vapor Phases; Pressure Regulators

20050203969 NASA Glenn Research Center, Cleveland, OH, USA

Unitized Regenerative Fuel Cell System Model Development

Burke, Kenneth A.; Jakupca, Ian; December 12, 2003; 1 pp.; In English; Fuel Cell Seminar, 1-5 Nov. 2004, San Antonio, TX, USA

Contract(s)/Grant(s): WBS 319-20-J1; No Copyright; Avail: Other Sources; Abstract Only

A Unitized Regenerative Fuel Cell (URFC) Energy Storage System is being developed at the NASA Glenn Research Center. This URFC system is unique in that it uses the surface area of the hydrogen and oxygen storage tanks as radiating heat surfaces for overall thermal control of the system. The tank surfaces also play an important role in the temperature control of regenerative gas dryers/humidifiers used to dry the hydrogen and oxygen gases produced by electrolysis during the charging and also used to humidify the hydrogen and oxygen gases used by fuel cell during the discharging of the URFCs. A bi-directional pressure controller is used to control the pressure of the oxygen and hydrogen gas inside the URFC stack during both charging and discharging of the URFC system. A water storage accumulator is used to store water reactant and control water pressure inside the URFC stack.

Author

Drying Apparatus; Regenerative Fuel Cells; Storage Tanks; Gas Pressure; Energy Storage

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SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20050199445 NASA Glenn Research Center, Cleveland, OH, USA

Ceiling Fires Studied to Simulate Low-Gravity Fires

Olson, Sandra L.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A unique new way to study low-gravity flames in normal gravity has been developed. To study flame structure and extinction characteristics in low-stretch environments, a normal gravity low-stretch diffusion flame was generated using a cylindrical PMMA sample of varying large radii, as shown in the photograph. These experiments have demonstrated that low-gravity flame characteristics can be generated in normal gravity through the proper use of scaling. On the basis of this work, it is feasible to apply this concept toward the development of an Earth-bound method of evaluating material flammability in various gravitational environments from normal gravity to microgravity, including the effects of partial gravity low-stretch rates such as those found on the Moon (1/6g) or Mars (1/3g). During these experiments, the surface regression rates for PMMA were measured for the first time over the full range of flammability in air, from blowoff at high stretch, to quenching at low stretch, as plotted in the graph. The solid line drawn through the central portion of the data (3\h100 sec-1) has a slope of unity, which indicates regression is proportional to stretch. The figure coordinates assume that the values of stretch are equivalent, whether derived from forced stretch or from buoyant stretch. The excellent correlation of the regression-rate data over the two-order-of-magnitude variation of stretch shows the reasonableness of this assumption.

Derived from text

Fires; Flames; Flammability; Gravitational Effects

20050199447 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Spread Across Liquids Continues to Fly

Miller, Fletcher J.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The physics and behavior of a flame spreading across a flammable liquid is an active area of research at the NASA Glenn Research Center. Spills of fuels and other liquids often result in considerable fire hazards, and much remains unknown about the details of how a flame, once ignited, moves across a pool. The depth of the liquid or size of the spill, the temperature, and wind, if any, can all complicate the combustion processes. In addition, with the advent of the International Space Station there may be fire hazards associated with cleaning, laboratory, or other fluids in space, and it is essential to understand the role that gravity plays in such situations. The Spread Across Liquids (SAL) experiment is an experimental and computational effort dedicated to understanding the detailed mechanisms of flame spread across a flammable liquid initially below its flashpoint temperature. The experimental research is being carried out in-house by a team of researchers from Glenn, the National Center for Microgravity Combustion, and Zin Technologies, with computer modeling being provided via a grant with the University of California, Irvine. Glenn's Zero Gravity Facility is used to achieve short microgravity periods, and normal gravity testing is done in the Space Experiments Laboratory. To achieve longer periods of microgravity, the showcase SAL hardware flies aboard a sounding rocket launched from White Sands Missile Range, New Mexico, approximately once per year. In addition

to extended microgravity, this carrier allows the use of detailed diagnostics that cannot be employed in a drop tower.

Derived from text

Flame Propagation; Computerized Simulation; Combustion Physics; Microgravity

20050199452 NASA Glenn Research Center, Cleveland, OH, USA

Growth and Morphology of Supercritical Fluids, a Fluid Physics Experiment Conducted on Mir, Complete

Wilkinson, R. Allen; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Growth and Morphology of Supercritical Fluids (GMSF) is an international experiment facilitated by the NASA Glenn Research Center and under the guidance of U.S. principal investigator Professor Hegseth of the University of New Orleans and three French coinvestigators: Daniel Beysens, Yves Garrabos, and Carole Chabot. The GMSF experiments were concluded in early 1999 on the Russian space station Mir. The experiments spanned the three science themes of near-critical phase separation rates, interface dynamics in near-critical boiling, and measurement of the spectrum of density fluctuation length scales very close to the critical point. The fluids used were pure CO₂ or SF₆. Three of the five thermostats used could adjust the sample volume with the scheduled crew time. Such a volume adjustment enabled variable sample densities around the critical density as well as pressure steps (as distinct from the usual temperature steps) applied to the sample. The French-built ALICE II facility was used for these experiments. It allows tightly thermostated (left photograph) samples (right photograph) to be controlled and viewed/measured. Its diagnostics include interferometry, shadowgraph, high-speed pressure measurements, and microscopy. Data were logged on DAT tapes, and PCMCIA cards and were returned to Earth only after the mission was over. The ground-breaking near critical boiling experiment has yielded the most results with a paper published in Physical Review Letters (ref. 1). The boiling work also received press in Science Magazine (ref. 2). This work showed that, in very compressible near-critical two-phase pure fluids, a vapor bubble was induced to temporarily overheat during a rapid heating of the sample wall. The temperature rise in the vapor was 23-percent higher than the rise in the driving container wall. The effect is due to adiabatic compression of the vapor bubble by the rapid expansion of fluid near the boundary during heatup. Thermal diffusivity is low near the critical point, so getting heat out of the compressed bubble is observably slow. This gives the appearance of a backward heat flow, or heat flow from a cold surface to a warm fluid.

Author

Supercritical Fluids; Morphology; Thermal Diffusivity; Fluid Dynamics; Heat Transmission

20050199456 NASA Glenn Research Center, Cleveland, OH, USA

Multiuser Droplet Combustion Apparatus Developed to Conduct Combustion Experiments

Myhre, Craig A.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A major portion of the energy produced in the world today comes from the combustion or burning of liquid hydrocarbon fuels in the form of droplets. However, despite vigorous scientific examinations for over a century, researchers still lack a full understanding of many fundamental combustion processes of liquid fuels. Understanding how these fuel droplets ignite, spread, and extinguish themselves will help us develop more efficient ways of energy production and propulsion, as well as help us deal better with the problems of combustion-generated pollution and fire hazards associated with liquid combustibles. The ability to conduct more controlled experiments in space, without the complication of gravity, provides scientists with an opportunity to examine these complicated processes closely. The Multiuser Droplet Combustion Apparatus (MDCA) supports this continued research under microgravity conditions. The objectives are to improve understanding of fundamental droplet phenomena affected by gravity, to use research results to advance droplet combustion science and technology on Earth, and to address issues of fire hazards associated with liquid combustibles on Earth and in space. MDCA is a multiuser facility designed to accommodate different combustion science experiments. The modular approach permits the on-orbit replacement of droplet combustion principal investigator experiments such as different fuels, droplet-dispensing needles, and droplet-tethering mechanisms. Large components such as the avionics, diagnostics, and base-plate remain on the International Space Station to reduce the launch mass of new experiments. MDCA is also designed to operate in concert with ground systems on Earth to minimize the involvement of the crew during orbit.

Author

Drops (Liquids); Combustion Physics; Microgravity; Liquid Fuels; Hydrocarbon Fuels; Combustion

20050199457 NASA Glenn Research Center, Cleveland, OH, USA

Combustion Module-2 Preparations Completed for SPACEHAB Mission Including the Addition of a New Major Experiment

Over, Ann P.; Research and Technology 2000; March 2001; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Combustion Module-1 (CM-1) was a large, state-of-the-art space shuttle Spacelab facility that was designed, built, and operated on STS-83 and STS-94 by a team from the NASA Glenn Research Center composed of civil servants and local support contractors (Analex and Zin Technologies). CM-1 accomplished the incredible task of providing a safe environment to support flammable and toxic gases while providing a suite of diagnostics for science measurements more extensive than any prior shuttle experiment (or anything since). Finally, CM-1 proved that multiple science investigations can be accommodated in one facility, a crucial step for Glenn's Fluids and Combustion Facility developed for the International Space Station. However, the story does not end with CM-1. In 1998, CM-2 was authorized to take the CM-1 accomplishments a big step further by completing three major steps: Converting the entire experiment to operate in a SPACEHAB module. Conducting an extensive hardware refurbishment and upgrading diagnostics (e.g., cameras, gas chromatograph, and numerous sensors). Adding a new, completely different combustion experiment.

Derived from text

Combustion Chambers; Spaceborne Experiments; Spacecraft Modules; Diagnosis; Flammable Gases

20050199465 NASA Glenn Research Center, Cleveland, OH, USA

Microgravity Emissions Laboratory Developed

Goodnight, Thomas W.; McNelis, Anne M.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Microgravity Emissions Laboratory (MEL) was developed for the support, simulation, and verification of the International Space Station microgravity environment. The MEL utilizes an inertial measurement system using acceleration emissions generated by various operating components of the space station. These emissions, if too large, could hinder the science performed on the space station by disturbing the microgravity environment. Typical test components are disk drives, pumps, motors, solenoids, fans, and cameras. These components will produce inertial forces, which disturb the microgravity on-orbit station environment. These components, usually housed within a station rack, must meet acceleration limits imposed at the rack interface for minimizing the onboard station-operating environment. The NASA Glenn Research Center developed this one-of-a-kind laboratory for testing components and, eventually, rack-level configurations. The MEL approach is to measure the component's generated inertial forces. This force is a product of the full diagonal mass matrix including the test setup (the center of gravity, mass moment of inertia, and weight) and the resolved diagonal rigid-body acceleration determined from measurements using the 10 apparatus accelerometers. The mass matrix can be test derived. The bifilar torsional pendulum method is used to measure the moment of inertia for the test component.

Derived from text

Cameras; Microgravity; Inertia; Accelerometers

20050199468 NASA Glenn Research Center, Cleveland, OH, USA

Microarthroscopy System With Image Processing Technology Developed for Minimally Invasive Surgery

Steele, Gynelle C.; Research and Technology 2000; March 2001; 1 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

In a joint effort, NASA, Micro Medical Devices, and the Cleveland Clinic have developed a microarthroscopy system with digital image processing. This system consists of a disposable endoscope the size of a needle that is aimed at expanding the use of minimally invasive surgery on the knee, ankle, and other small joints. This device not only allows surgeons to make smaller incisions (by improving the clarity and brightness of images), but it gives them a better view of the injured area to make more accurate diagnoses. Because of its small size, the endoscope helps reduce physical trauma and speeds patient recovery. The faster recovery rate also makes the system cost effective for patients. The digital image processing software used with the device was originally developed by the NASA Glenn Research Center to conduct computer simulations of satellite positioning in space. It was later modified to reflect lessons learned in enhancing photographic images in support of the Center's microgravity program. Glenn's Photovoltaic Branch and Graphics and Visualization Lab (G-VIS) computer programmers and software developers enhanced and speed up graphic imaging for this application. Mary Vickerman at Glenn developed algorithms that enabled Micro Medical Devices to eliminate interference and improve the images.

Author

Computerized Simulation; Diagnosis; Endoscopes; Image Processing; Medical Equipment; Microgravity

20050201799 NASA Glenn Research Center, Cleveland, OH, USA

Microgravity Experiments on Bubble Removal in the Hydrodynamic Focusing Bioreactor - Space (HFB-S)

Nahra, H. K.; Niederhaus, C. E.; Robinson, S.; Hudson, E.; Geffert, S. K.; Lupo, P. J.; Gonda, S. R.; Kleis, S. J.; Kizito, J. P.; January 2005; 1 pp.; In English; 2004 NASA Cell Science Conference, 26-28 Feb. 2004, Palo Alto, CA, USA
Contract(s)/Grant(s): RTOP 101-51-0A; Copyright; Avail: Other Sources; Abstract Only

The Hydrodynamic Focusing Bioreactor-Space (HFB-S) is being developed as a possible replacement for the Rotating Wall Perfused Vessel (RWPV) bioreactor currently planned for use on the International Space Station (ISS). The HFB-S is being developed with the ability to remove gas bubbles that may inadvertently enter the system during long duration experiments (approx. 1-3 months). The RWPV has been used in the past with great success on Shuttle flights and Mir missions, but has occasionally experienced problems with gas bubbles entering the fluid-filled vessel. These bubbles are harmful to the cell science, and bubble removal in the RWPV is problematic. The HFB-S has an access port on the rotation axis that allows for bubble removal under specific operating conditions without detrimentally affecting the cell tissue. Experiments on bubble removal with the HFB-S were conducted in the microgravity environment on NASA's KC-135 Reduced Gravity Aircraft. The first set of flights provided useful data on bubble trajectories that are validating computational predictions. The second set of flights free-floated the apparatus and tested the most recent configuration of the bioreactor while focusing on the bubble removal process itself. These experiments have shown that gas bubbles can successfully be driven to the removal port and purged in microgravity. The last day's experiments had an excellent microgravity environment due to calm air, and the experience gained in previous flights allowed successful bubble removal 18 out of 35 tries, remarkable given the microgravity time constraints and g-jitter on the KC-135.

Author

Microgravity; Weightlessness Simulation; Bubbles; Bioreactors

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ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20050200895 Mitre Corp., McLean, VA USA

Tactical Infrasound

Stubbs, Christopher; Brenner, Michael; Bildsten, Lars; Dimotakis, Paul; Flatte, Stanley; Goodman, Jeremy; Hearing, Brian; Max, Claire; Schwitters, Roy; Tonry, John; May 2005; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A435517; JSR-03-520; No Copyright; Avail: Defense Technical Information Center (DTIC)

JASON was asked to assist the U.S. Army's National Ground Intelligence (NGIC) in finding ways to enhance the effectiveness of infrasound monitoring. In addition, we were also tasked with determining whether infrasound monitoring was likely to provide information of value in other intelligence venues.

DTIC

Infrasound Frequencies; Intelligence

20050200925 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site: Open Field Scoring Record No. 364

Overbay, Larry, Jr.; Boutin, Matthew; Archiabile, Robert; McClung, Christina; Robitaille, George; May 2005; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8-CO-160-UXO-021

Report No.(s): AD-A435577; ATC-8980; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of U.S. Army Corps of Engineers Engineering Research and Development Center (ERDC) to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Open Field. the scoring record was coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analyses, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Ordnance; Scoring; Standardization

20050200944 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Open Field Scoring Record No. 442

Overbay, Larry, Jr.; Boutin, Matthew; Archiabile, Robert; Fling, Rick; McClung, Christina; Robitaille, George; May 2005; 96 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435625; ATC-8982; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of Human Factors Applications, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Open Field. The scoring record was coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Detection; Magnetometers; Ordnance; Scoring; Standardization; Test Facilities

20050200946 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 238

Overbay, Larry, Jr.; Boutin, Matthew; Archiabile, Robert; Fling, Rick; McClung, Christina; Robitaille, George; Jun. 2005; 105 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435628; ATC-8968; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of Human Factors Applications to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG standardized UXO Technology Demonstration Site Blind Grid. The scoring record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Detection; Magnetometers; Ordnance; Scoring; Standardization; Test Facilities

20050201007 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Demonstration Site Blind Grid Scoring Record No. 690

Overbay, Larry, Jr.; Archiabile, Robert; McClung, Christina; Robitaille, George; Apr. 2005; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435731; ATC-8953; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of Parsons to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Blind Grid. The scoring record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Anomalies; Detection; Electromagnetism; Ordnance; Scoring; Standardization

20050201008 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 396

Overbay, Larry, Jr.; Boutin, Matthew; Fling, Rick; McClung, Christina; Robitaille, George; May 2005; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435732; ATC-8965; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of NAEVA Geophysics, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG standardized UXO technology Demonstration Site Blind Grid. The scoring record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Detection; Global Positioning System; Ordnance; Scoring; Standardization

20050201009 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 268

Overbay, Larry, Jr.; Fling, Rick; McClung, Christina; Robitaille, George; Apr. 2005; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435733; ATC-8760; No Copyright; Avail: Defense Technical Information Center (DTIC)

This scoring record documents the efforts of G-TEK Australia PTY Limited to detect and discriminate inter unexploded ordnance (UXO) utilizing the APG standardized UXO Technology Demonstration Site Blind Grid. The scoring record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Detection; Magnetometers; Ordnance; Scoring; Standardization

20050201021 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA
Design Accelerations for the Army's Excalibur Projectile

Cordes, J. A.; Vega, J.; Carlucci, D.; Chaplin, R. C.; Jun. 2005; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435761; ARAET-TR-05008; No Copyright; Avail: CASI; [A03](#), Hardcopy

Excalibur is the Army's new 155-mm, guided projectile. It is scheduled for fielding in 2008. The objectives of Excalibur's test program are: 1) shake-out the weak systems for redesign by testing at a margin load, 2) characterize the gun-launch loads for design improvements and failure reviews, and 3) demonstrate structural integrity and operability after gun launch. In this paper, 10 live-firings at the margin load, PMP +5%, are presented. Averages, standard deviations, and statistical correlations are given.

DTIC

Projectiles; System Effectiveness; Weapon Systems

20050203735 XL Technology Systems, Inc., USA

Low Vibration 35' Cryopump

Kobel, Ted; 23rd Space Simulation Conference Proceedings; [2005]; 33 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

XL Technology Systems, Inc. (XL) has designed, developed and manufactured a 35 in. cryopump for applications requiring low vibration disturbances, high pumping speeds, high capacity and high reliability. Typical cryopumps utilize conventional Gifford-McMahon (GM) or Stirling cycle cryorefrigerators. Such machines operate with a piston or displacer type design that produces g-forces of significant magnitude relative to acceptable levels needed in critical applications including the testing of space hardware that demand very low vibration inputs. The XL Low Vibration Cryopump utilizes a commercially available cryorefrigerator with high reliability that operates with a two-stage, non-displacer type 'Pulse Tube' cold head. This non-displacer cryopump operates with vibration levels that are at least an order of magnitude lower than attainable with the GM or Stirling cycle-driven cryopumps. A side benefit of the Pulse Tube cold head is the lack of magnetic gradient disturbance that would be caused using a GM or Stirling cycle cold head with the cycling displacer. The XL 35 in. Low Vibration Cryopump provides pumping speeds and capacity equal to or greater than conventional cryopumps of this size that operate with GM or Stirling cycle cold heads.

Author

Cryopumping; Cryogenic Fluids; Pumps

32

COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue, see 03 Air Transportation and Safety; and 16 Space Transportation and Safety.

20050199649 NASA Glenn Research Center, Cleveland, OH, USA

Status of the Direct Data Distribution (D(exp 3)) Experiment

Wald, Lawrence; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

NASA Glenn Research Center's Direct Data Distribution (D3) project will demonstrate an advanced, high-performance communications system that transmits information from an advanced technology payload carried by a NASA spacecraft in low Earth orbit (LEO) to a small receiving terminal on Earth. The space-based communications package will utilize a solid-state, K-band phased-array antenna that electronically steers the radiated energy beam toward a low-cost, tracking ground terminal, thereby providing agile, vibration-free, electronic steering at reduced size and weight with increased reliability. The array-based link will also demonstrate new digital processing technology that will allow the transmission of substantially increased amounts of latency-tolerant data collected from the LEO spacecraft directly to NASA field centers, principal investigators, or into the commercial terrestrial communications network. The technologies demonstrated by D3 will facilitate NASA's transition from using Government-owned communication assets to using commercial communication services. The hardware for D3 will incorporate advanced technology components developed under the High Rate Data Delivery (HRDD) Thrust Area of NASA's Office of Aerospace Technology Space Base Program at Glenn's Communications Technology Division. The flight segment components will include the electrically steerable phased-array antenna, which is being built by the Raytheon System Corporation and utilizes monolithic microwave integrated circuit (MMIC) technology operating at 19.05 GHz; and the digital encoder/modulator chipset, which uses four-channel orthogonal frequency division multiplexing (OFDM). The encoder/modulator will use a chipset developed by SICOM, Inc., which is both bandwidth and power efficient. The ground segment components will include a low-cost, open-loop tracking ground terminal incorporating a cryoreceiver to minimize terminal size without compromising receiver capability. The project is planning to hold a critical design review in the second quarter of fiscal year 2002.

Author

Telecommunication; Low Earth Orbits; Payloads; Communication Networks; Information Systems; Phased Arrays; Antenna Arrays

20050199688 Massachusetts Inst. of Tech., Cambridge, MA, USA

Reconfigurable Modem for Ocean Observatories

Soezer, E. M.; January 2004; 22 pp.; In English

Contract(s)/Grant(s): NA86RG0074

Report No.(s): PB2005-107638; MTSG-05-4; Copyright; Avail: National Technical Information Service (NTIS)

Acoustic communications is an important part of underwater research. The mass amount of data collected by sub-sea devices can be made available to the scientific community in real-time with the utilization of acoustic modems. Sensor data collected by the sub-sea devices, including but not limited to pictures, depth, currents, sonar images, traditionally are stored in the observation post until the end of the mission. By employing a high speed acoustic link between the observation post and a gateway, which is connected to the command and control station through a radio link, we can reach the data in real time. NTIS

Acoustics; Modems; Oceans; Sea Water; Sound Transmission; Underwater Communication

20050200789 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Modification of a Modulation Recognition Algorithm to Enable Multi-Carrier Recognition

Waters, Angela M.; Mar. 2005; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435255; AFIT/GE/ENG/05-23; No Copyright; Avail: CASI; [A04](#), Hardcopy

Modulation recognition is important for both military and commercial communication applications, particularly in cases where enhanced situation awareness and/or channel assessment is required to mitigate intentional or collateral interference. Modulation recognition via template matching or statistical analysis is a key aspect of non-cooperative (nonmatched filtering) signal interception, classification, and exploitation. This research concerns the evaluation and modification of a conventional Digitally Modulated Signal Recognition Algorithm (DMRA) to enable multi-carrier, Orthogonal Frequency Division Multiplexing (OFDM), waveform recognition. The original DMRA architecture was developed to classify communication signals for three fundamental data modulations, i.e., Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), and Frequency Shift Keying (FSK). By adding an additional key feature and threshold to the original DMRA architecture, a modified DMRA architecture is developed to enable the reliable recognition of OFDM waveforms. Simulation results for the modified DMRA architecture show a 95.25% success rate for OFDM waveform recognition at a signal-to-noise ratio (SNR) of 11:0 dB. When operated under scenarios where FSK signals are neither present nor considered an alternative, the modified DMRA architecture yields success rates of 100%, 98.25%, and 98.25% for classifying PSK2, PSK4, and OFDM at a SNR of 5.0 dB.

DTIC

Algorithms; Demodulation; Interception; Modulation; Signal Processing

20050200926 Naval Postgraduate School, Monterey, CA USA

Evaluation of Logistics Operation Command and Control Capability: Optimization Revisited

Ozkan, Recep; Jun. 2005; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435578; No Copyright; Avail: Defense Technical Information Center (DTIC)

Logistics Operations Command and Control Capability Concept (LOCCC), developed by Jeff Grelson in 2000, introduces a new distribution principle to combat elements. This concept employs a supporting logistics unit in a general support role and controls it by a unique command center in order to minimize the footprint left by logistics, improve logistic and tactical responsiveness, and reduce the iron mountain on the battlefield. This thesis revisits the mathematical models and algorithms developed by Major Thomas Lenhardt to model LOCCC. We preprocess the network topology in order to convert it into an equivalent, simplified network that is computationally tractable with the existing optimization model by using exact and heuristic algorithms. We show that the simplifications and enhancements we propose help us to obtain much faster and better quality solutions than using the original, non-simplified networks. For example, in a ten-minute run, we can obtain a solution that is 98% better in some cases. We also apply the model to a Turkish Infantry Brigade to evaluate LOCCC with sustainment requirements and transportation assets of the Turkish Army.

DTIC

Command and Control; Logistics; Logistics Management; Military Operations

20050201042 Naval Postgraduate School, Monterey, CA USA

A Performance Analysis of Management Information Due to Data Traffic Provisioning in a SONET/SDH Communications Network

Tay, Yeong K.; Jun. 2005; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435791; No Copyright; Avail: Defense Technical Information Center (DTIC)

An evaluation of the performance of a SONET management system was conducted to better understand its management capabilities due to network disruptions in the presence of a traffic load. This study analyzed the Cisco Transport Manager (CTM) which manages a testbed of four Cisco ONS 15454 optical systems. The network was injected with HTTP and FTP traffic generated by the Spirent Smartbits system installed with TeraMetrics Gigabit Ethernet modules and load calibration configured by the Spirent Avalanche software. To simulate real-world situations, power disruptions were applied to the network while collecting CTM traffic using Ethereal. Using queuing analysis, the arrival rates and service times were computed for various CTM traffic components and a utilization for 2500 network elements (NE) extrapolated. Self-similarity analysis was performed and the log-variance was plotted to extract the Hurst values. Finally, the results and findings were compared with prior research for loading and no-loading cases. The results of this study are useful in determining the maximum number of network elements manageable in a disruptive environment. Final analysis on the effects of link utilization on the queue size showed that the CTM is able to manage more NEs when the network is disrupted. Unfortunately, managing more NEs increases the queue size even though the utilization was found to be 0.83 for 5450 NEs. Consequently, in order to maintain a moderate queue size, the maximum number of NEs manageable was found to be 2495. This value is close to CISCO's specification of a CTM server managing a maximum of 2500 NEs.

DTIC

Communication Networks; Information Management; Management Information Systems; Provisioning; Reliability Analysis; Traffic

20050201066 Illinois Univ., Urbana-Champaign, IL USA

Reduced-Complexity Models for Network Performance Prediction

Srikant, Rayadurgam; Hajek, Bruce; May 2005; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-2-0542; Proj-K144

Report No.(s): AD-A435841; AFRL-IF-RS-TR-2005-214; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Internet consists of thousands of nodes interconnected in complex ways, with millions of users sending traffic over the network. To understand such a complex system it is necessary to develop accurate, yet simple, models to describe the performance of the network. The models have to then be used to design new algorithms that dramatically improve network performance. In this project, a variety of new models were developed to capture many phenomena in the Internet.

DTIC

Communication Networks; Mathematical Models; Networks; Performance Prediction; Wireless Communication

20050201095 Naval Postgraduate School, Monterey, CA USA

NPS Center for Autonomous Underwater Vehicle (AUV) Research

Kragelund, Sean; Mar. 2004; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435909; NPS-MAE-04-002; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report presents a summary of the work completed in 2003 at the NPS center for Autonomous Underwater Vehicle (AUV) Research and provides a preview of future work planned for 2004.

DTIC

Autonomous Navigation; Autonomy; Underwater Communication; Underwater Vehicles

20050201602 Army War Coll., Carlisle Barracks, PA USA

The Status of the Transition of Strategic C4 Systems in the Department of Defense and the U.S. Army War College Issue Paper Volume 07-05, June 2005

Waddell, Bill; Jun. 2005; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435971; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Department of Defense (DOD) is in the middle of a transition with regard to the strategic command, control, communications and computer (C4) systems being used at the Joint operational and strategic levels of warfighting and planning. This transition affects the U.S. Army War College's (USAWC) areas of education, collaboration, and outreach as students prepare for future leadership roles. The current system of record, the Global Command and Control System (GCCS), has been in use since 1996, and is being phased into the emerging system, identified as the Joint Command and Control (JC2) system. This phasing includes the continuity of current strategic and operational level C4 capabilities, and will expand to include the tactical level C4 tools and capabilities currently residing in the Army Battle Command System (ABCS). This transition is scheduled to be smooth; JC2 will take the attributes and operating system of GCCS. JC2 will not include the current initiatives in the areas of force planning and collaboration, tools utilized to conduct these missions will continue to be outside of the purview of the established strategic C4 system. This paper will discuss the projected transition in strategic C4, identifying the emerging tools and capabilities in JC2, and also discuss emerging capabilities in the areas of force planning and collaboration systems. It will focus on the impact of the use of these tools and capabilities at USAWC for education, research, and outreach.

DTIC

Command and Control; Defense Program; Universities; Warfare

20050201663 Naval Postgraduate School, Monterey, CA USA

Analysis of Tobyhanna Army Depot's Radio Frequency Identification (RFID) pilot Program: RFID as an Asset Management Tool

Miertschin, Keith W.; Forrest, Brian D.; Jun. 2005; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435736; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of this MBA project is to identify the potential value of Radio Frequency Identification (RFID) used for inventory and asset management at the Tobyhanna Army Maintenance Depot. Tobyhanna Army Depot recently partnered with WhereNet Corporation for a pilot program to incorporate a real-time locating system that uses RFID. The pilot program tracks the AN/TPS-75 and AN/TRC-170 systems through the maintenance processes to determine if RFID is beneficial. The RFID asset management system proved beneficial to increase process efficiency and reduce the number of wasted labor hours used to find misplaced items. The cost-benefit analysis at the Tobyhanna Army Depot RFID pilot program indicates a Return on Investment of less than one year and supports previous research conducted on RFID as an asset management tool. Tobyhanna's investment in advancing technology essentially paid for itself within one year when measured in labor cost savings and yielded an annual savings of 837 Repair Cycle Time days. Since the primary infrastructure for RFID is already funded and fully operational, the payoff period on incremental investment is likely to be much shorter in the future.

DTIC

Radio Frequencies; Inventory Management; Management Systems

20050201705 Bonn Univ., Germany

The Bonn Astro/Geo Mark IV Correlator

Bertarini, Alessandra; Mueskens, Arno; Alef, Walter; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 147-150; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The Bonn Mark IV VLBI correlator is operated jointly by the MPIfR and the GIUB in Bonn and the BKG in Frankfurt. In 2004 Gbit/s correlation and ftp-VLBI fringe tests were conducted successfully for the first time.

Author

Correlators; Very Long Base Interferometry

20050201713 Massachusetts Inst. of Tech., Westford, MA, USA

Westford Antenna

Poirier, Mike; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 121-124; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Technical information is provided about the antenna and VLBI equipment at the Westford site of Haystack Observatory, and about changes to the systems since the 2003 IVS Annual Report.

Author

Observatories; Very Long Base Interferometry; Cassegrain Antennas; Geodesy; Parabolic Antennas

20050201724 National Inst. of Polar Research, Tokyo, Japan

JARE Syowa Station 11-m Antenna, Antarctica

Shibuya, Kazuo; Doi, Koichiro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 107-110; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The operation of the 11 m S/X band antenna at Syowa Station (69.0 S, 39.6 E) by the Japanese Antarctic Research Expeditions (JAREs) started in February 1998 and continues till today (February 2005). The number of quasi-regular geodetic VLBI experiments attained 57 at the end of 2004. We summarize the status of the experiments. We replaced the K4 back-end terminal with a K5 terminal. Fringe detection test was made on September 9, 2004, with the 32 m GSI/Tsukuba antenna. It was proven successful after Intelsat transfer of data (about 200 MB) from Syowa Station to GSI/Tsukuba and correlated there. The antenna time drastically decreased as receiving activity of remote sensing satellites became very low. We will increase, with the help of the observing program committee, the OHIG and CRF sessions than those planned in the 2005 year schedule (eight 24 hr sessions).

Author

Antarctic Regions; Geodesy; Very Long Base Interferometry; Microwave Antennas; Ground Stations

20050201891 NASA Glenn Research Center, Cleveland, OH, USA, Cisco Systems, Inc., USA

Mobile Router Developed and Tested

Ivancic, William D.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center, under a NASA Space Act Agreement with Cisco Systems, has been performing joint networking research to apply Internet-based technologies and protocols to space-based communications. As a result of this research, NASA performed stringent performance testing of the mobile router, including the interaction of routing and the transport-level protocol. In addition, Cisco Systems developed the mobile router for both commercial and Government markets. The code has become part of the Cisco Systems Internetworking Operating System (IOS) as of release 12.2 (4) T--which will make this capability available to the community at large. The mobile router is software code that resides in a network router and enables entire networks to roam while maintaining connectivity to the Internet. This router code is pertinent to a myriad of applications for both Government and commercial sectors, including the 'wireless battlefield.' NASA and the Department of Defense will utilize this technology for near-planetary observation and sensing spacecraft. It is also a key enabling technology for aviation-based information applications. Mobile routing will make it possible for information such as weather, air traffic control, voice, and video to be transmitted to aircraft using Internet-based protocols. This technology shows great promise in reducing congested airways and mitigating aviation disasters due to bad weather. The mobile router can also be incorporated into emergency vehicles (such as ambulances and life-flight aircraft) to provide real-time connectivity back to the hospital and health-care experts, enabling the timely application of emergency care. Commercial applications include entertainment services, Internet protocol (IP) telephone, and Internet connectivity for cruise ships, commercial shipping, tour buses, aircraft, and eventually cars. A mobile router, which is based on mobile IP, allows hosts (mobile nodes) to seamlessly 'roam' among various IP subnetworks. This is essential in many wireless networks. A mobile router, unlike a mobile IP node, allows entire networks to roam. Hence, a device connected to the mobile router does not need to be a mobile node because the mobile router provides the roaming capabilities. There are three basic elements in the mobile IP: the home

agent, the foreign agent, and the mobile node. The home agent is a router on a mobile node's home network that tunnels datagrams for delivery to the mobile node when it is away from home. The foreign agent is a router on a remote network that provides routing services to a registered mobile node. The mobile node is a host or router that changes its point of attachment from one network or subnetwork to another. In mobile routing, virtual communications are maintained by the home agent, which forwards all packets for the mobile networks to the foreign agent. The foreign agent passes the packets to the mobile router, which then forwards the packets to the devices on its networks. As the mobile router moves, it will register with its home agent on its whereabouts via the foreign agent to assure continuous connectivity.

Author

Mobile Communication Systems; Internets; Fabrication; Computer Networks

20050201892 NASA Glenn Research Center, Cleveland, OH, USA

Digital Distortion Caused by Traveling- Wave-Tube Amplifiers Simulated

Kory, Carol L.; Andro, Monty; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Future NASA missions demand increased data rates in satellite communications for near real-time transmission of large volumes of remote data. Increased data rates necessitate higher order digital modulation schemes and larger system bandwidth, which place stricter requirements on the allowable distortion caused by the high-power amplifier, or the traveling-wave-tube amplifier (TWTA). In particular, intersymbol interference caused by the TWTA becomes a major consideration for accurate data detection at the receiver. Experimentally investigating the effects of the physical TWTA on intersymbol interference would be prohibitively expensive, as it would require manufacturing numerous amplifiers in addition to acquiring the required digital hardware. Thus, an accurate computational model is essential to predict the effects of the TWTA on system-level performance when a communication system is being designed with adequate digital integrity for high data rates. A fully three-dimensional, time-dependent, TWT interaction model has been developed using the electromagnetic particle-in-cell code MAFIA (Solution of Maxwell's equations by the Finite-Integration-Algorithm). It comprehensively takes into account the effects of frequency-dependent AM (amplitude modulation)/AM and AM/PM (phase modulation) conversion, gain and phase ripple due to reflections, drive-induced oscillations, harmonic generation, intermodulation products, and backward waves. This physics-based TWT model can be used to give a direct description of the effects of the nonlinear TWT on the operational signal as a function of the physical device. Users can define arbitrary excitation functions so that higher order modulated digital signals can be used as input and that computations can directly correlate intersymbol interference with TWT parameters. Standard practice involves using communication-system-level software packages, such as SPW, to predict if adequate signal detection will be achieved. These models use a nonlinear, black-box model to represent the TWTA. The models vary in complexity, but most make several assumptions regarding the operation of the high-power amplifier. When the MAFIA TWT interaction model was used, these assumptions were found to be in significant error. In addition, digital signal performance, including intersymbol interference, was compared using direct data input into the MAFIA model and using the system-level analysis tool SPW for several higher order modulation schemes. Results show significant differences in predicted degradation between SPW and MAFIA simulations, demonstrating the significance of the TWTA approximations made in the SPW model on digital signal performance. For example, a comparison of the SPW and MAFIA output constellation diagrams for a 16-ary quadrature amplitude modulation (16-QAM) signal (data shown only for second and fourth quadrants) is shown. The upper-bound degradation was calculated from the corresponding eye diagrams. In comparison to SPW simulations, the MAFIA data resulted in a 3.6-dB larger degradation.

Author

Distortion; Satellite Communication; Simulation; Traveling Wave Amplifiers; Pulse Communication

20050201939 Lawrence Livermore National Lab., Livermore, CA USA

iES: An Intelligent Electronic Sales Platform

Korbe, W.; Stanton, V.; Gao, J.; Oct. 2003; 20 pp.; In English

Report No.(s): DE2005-15013834; UCRL-CONF-200487; No Copyright; Avail: Department of Energy Information Bridge

Current e-commerce systems support online shopping based on electronic product catalogs. The major issues associated with catalog-based commerce systems are: difficulty in distinguishing one retailer from another, complex navigation with confusing links, and a lack of personalized service. This paper reports an intelligent solution to address these issues. Our solution will provide a more personalized sales experience through the use of a transaction-based knowledge model that includes both the rules used for reasoning as well as the corresponding actions. Based on this solution, we have developed an intelligent electronic sales platform that is supported by a framework which provides the desired personalization as well

as extensibility and customization capabilities. This paper reports our design and development of this system and application examples.

NTIS

Commerce; Computer Networks; Electronic Commerce

20050203760 Hi Pi Consulting, Gaithersburg, MD, USA

Overview, Testing, and Solutions to ESD-Induced, Solar-array-string, On-orbit Failures

Meulenberg, A.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 58-63; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

Geostationary satellites have had sections of their high-voltage GaAs (and perhaps silicon) solar arrays fail abruptly on orbit. The recent (1997/8) occurrence of the problem was shown to correlate highly with active Geomagnetic-substorm activity (of the type that can result in spacecraft charging events) and thus was attributed to electrostatic discharge (ESD). A review of the cause and damage and the solutions to the problem. A comparison is made between several aspects of silicon and GaAs cells and how these could affect the probability of such damage. An extended discussion of the various points includes speculation about earlier solar-cell-string failures on silicon arrays.

Author

Performance Tests; Electrostatic Charge; Solar Arrays; Failure; Geosynchronous Orbits

20050203779 National Space Development Agency, Tsukuba, Japan

Flight Data of GaAs Solar Cells on the COMETS

Ohshima, Takeshi; Nashiyama, Isamu; Itoh, Hisayoshi; Okada, Sohei; Nakao, Tetsuya, et al.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 64-73; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

Communication and Broadcasting Engineering Test Satellite (COMETS), which was not put into the scheduled geostationary orbit by the failure of H-II rocket, become a result of flying in the more severe radiation environment than predicted. By this result, the necessity of re-prediction of the degradation of solar array paddle performance occurred. In order to predict again we carried out the irradiation tests of solar cells on the earth. In this paper this irradiation tests results are shown. And this results were examined based on simulation results using the TRIM code. Then the results of re-prediction of solar array paddle performance and actual flight data shown.

Author

Data Acquisition; Solar Cells; Gallium Arsenides; Communication Satellites

20050203815 Belgrade Univ., Yugoslavia

International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004)

[2004]; In English; International Conference on Advances in Infrastructure for Internet, Processing, Systems and Interdisciplinaries, 1-4 Apr. 2004, Kopaonik, Serbia; See also 20050203816 - 20050203835; Copyright; Avail: CASI; [C01](#), CD-ROM

Contents include the following: Natural language technology in multi-source information fusion. The place of the internet in research into the history of science; three case studies. A method for brain electrical activity visualization. An approach to control multi-agent systems. Performance of parallel iterative solution of linear systems using GMRES. Generic intelligent personal information agent. Automatic configuration of security parameters in IP network.

CASI

Natural Language (Computers); Linear Systems; Internets; Brain

20050203896 Pennsylvania State Univ., University Park, PA, USA

Rural America's Access to Broadband: A Preliminary Assessment of North Dakota and Pennsylvania

Tate, Marsha A.; Sager, Sheila S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 77 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A05](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Today, the socioeconomic fate of rural communities is inextricably linked to the quality and speed of access to Internet services, and content. However, a thorough understanding of the resources necessary for communities to achieve full access

to the network is necessary. These resources can be grouped into four determinants of access: context; connectivity; capability; and, content here referred to as the 4C s theory. Using data gathered for five rural counties in Pennsylvania and North Dakota, this paper frames rural high-speed Internet access in terms of the 4C s theory. Our analyses suggest there are significant variations between the two states and among individual counties. Moreover, in order to sustain socio-economic success, each of the 4C s must be considered both individually and collectively.

Author

Rural Areas; Broadband; North Dakota; Pennsylvania; United States; Telecommunication

20050203914 Electronics and Telecommunications Research Inst., Daejeon, Korea, Republic of
High Quality Image Watermarking on the Lowest Wavelet Subband

Joo, Sanghyun; Hong, Jin Woo; Shin, Jaeho; Kikuchi, Hisakazu; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 6 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper, we propose a robust blind watermarking that embeds a pseudo-random binary watermark sequence into the lowest wavelet subband. Although it is known that the lowest subband embedding cause severe degradation, we overcome the degradation by employing two techniques. First, watermarks are adaptively embedded by considering human visual system. Second, watermark embedding is skipped for some coefficients that cause severe degradation. Owing to these techniques, a good fidelity and robustness can be obtained simultaneously.

Author

Wavelet Analysis; Multimedia; Image Processing

20050203982 NASA Langley Research Center, Hampton, VA, USA

Optimum Integrated Heterodyne Photoreceiver for Coherent Lidar Applications

Amzajerjian, Farzin; Pierrottet, Diego; Singh, Upendra; Kavaya, Michael; [2005]; 7 pp.; In English; Materials Research Society Spring Meeting, 28 Mar. - 1 Apr. 2005, San Francisco, CA, USA

Contract(s)/Grant(s): 23-258-80-RR

Report No.(s): Paper FF6.3; No Copyright; Avail: CASI; [A02](#), Hardcopy

Many coherent lidar applications, particularly airborne and space-based applications, impose stringent power and size constraints while requiring high levels of sensitivity. For this reason, optimization of the lidar heterodyne photoreceiver is one of the critical steps in ensuring full utilization of limited resources to achieve the required sensitivity. The analysis of 2-micron heterodyne receivers shows that substantial improvement of the order of 3 dB can be obtained by proper optimization of the receiver key control parameters and elimination of its parasitic capacitances by integrating the detector, its bias circuit, and the preamplifier on a single substrate. This paper describes analytical steps for defining optimum heterodyne receiver design parameters and development of experimental devices operating at 2-micron wavelength.

Author

Optical Radar; Optimization; Receivers; Mathematical Models; Coherent Radar; Optical Heterodyning

33

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20050199463 NASA Glenn Research Center, Cleveland, OH, USA

High-Voltage Droplet Dispenser Developed

Eichenberg, Dennis J.; VanderWal, Randy L.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Various techniques have been applied to deploying individual droplets for many applications, such as the study of the combustion of liquid fuels. Isolated droplet studies are useful in that they allow phenomena to be studied under well-controlled and simplified conditions. A high-voltage droplet dispenser has been developed that is extremely effective in dispensing a wide range of droplets. The dispenser is quite unique in that it utilizes a droplet bias voltage, as well as an ionization pulse, to release the droplet. The droplet is deployed from the end of a needle. A flat-tipped, stainless steel needle attached to a syringe

dispenses a known value of liquid that hangs on the needle tip. Somewhat below the droplet is an annular ring electrode. A bias voltage, followed by a voltage pulse, is applied to attract the droplet sufficiently to pull it off the needle. The droplet and needle are oppositely charged relative to the annular electrode. The needle is negatively charged, and the annular ring is positively charged.

Derived from text

Dispensers; Electric Potential; Drops (Liquids)

20050200855 Air Force Research Lab., Wright-Patterson AFB, OH USA

RF Performance Evaluation of Ferroelectric Varactor Shunt Switches

Neidhard, Robert; Nykiel, Edward; Ebel, John; Strawser, Richard; Stamper, Keith; Calcaterra, Mark; Biggers, Rand; Subramanyam, Guru; Ahamed, Faruque; Jun. 2005; 16 pp.; In English

Contract(s)/Grant(s): FA8650-04-2-4201; Proj-6096

Report No.(s): AD-A435427; AFRL-SN-WP-TR-2005-106; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper addresses experimental RF performance evaluation, and electrical parameter extraction of different size ferroelectric varactor shunt switches. The ferroelectric varactor shunt switch operation is based on nonlinear dielectric tunability of a Ba_{0.6}Sr_{0.4}TiO₃ (BST) thin-film sandwiched between two metal layers in the parallel plate configuration. Coplanar waveguide implementation of the varactor shunt switch results in a high speed RF switch, with a simple two-metal layer Si MMIC compatible process on high resistivity Si substrates. Experimental RF performance of the switches show low insertion loss for smaller area devices, with good isolation for larger area devices. To optimize the device design, RF performance of multiple devices were tested, and electrical parameters were extracted. The capacitance of the varactor shunt switches tested were tunable more than 4:1 for bias voltages below 12 V. The switching speed of the devices tested was approximately 43 ns based on the step response measurements.

DTIC

Bypasses; Capacitance; Circuits; Evaluation; Ferroelectric Materials; Ferroelectricity; Performance Tests; Radio Frequencies; Switches; Transmission Lines; Varactor Diodes

20050200860 Naval Postgraduate School, Monterey, CA USA

The Photovoltaic Power Converter: A Technology Readiness Assessment

Ansley, Steven R., Jr.; Phillips, Lewis H.; Jun. 2005; 147 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435434; No Copyright; Avail: Defense Technical Information Center (DTIC)

With the DoD moving towards evolutionary acquisition and incremental development of weapons systems and soldier applications, it is important that the maturity of new technologies be properly assessed so that the probability of success, once inserted into a program, can be maximized. The purpose of this report is to examine the Photovoltaic Power Converter (PVPC) technology, developed by Atira Technologies, as a potential Department of Defense Acquisition program/project. Specifically, the report focuses on a Technology Readiness Assessment (TRA). The report validates the PVPC technology and estimates, with 95% confidence, that the PVPC enables a solar power system to convert between 30.39% and 48.60% more solar energy into power than an identical system without the PVPC. The report also identifies and documents the required supporting information to justify a Technology Readiness Level (TRL) 5 for the PVPC. Finally, the report recommends inserting the PVPC into the DoD Acquisition System as a commercial item via horizontal technology insertion or the Advanced Concept Technology Demonstration Program.

DTIC

Photovoltaic Effect; Solar Energy; Technology Assessment

20050200874 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of 802.16A

Allen, Jared L.; Jun. 2005; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435472; No Copyright; Avail: Defense Technical Information Center (DTIC)

With the ever-increasing popularity of wireless internet, its scale is broadening. While the IEEE 802.15 standard provides the parameters necessary for a wireless personal area network (WPAN), the IEEE 802.16a standard provides broadband wireless access (BWA), or a wireless metropolitan area network (WMAN). Popularly referred to as Wi-Max, the standard uses cellular topography with a base station and subscriber station and cuts down on infrastructure and thus can be used in most environments. The 802.16a standard can take advantage of the popular OFDM modulation technique. This thesis takes a

developed synchronization algorithm and tests its performance on 802.16a. In addition, it tests the standard's performance in different types of channel. Various techniques are evaluated including interleaving and antenna diversity. The 802.16a standard employs a form of transmit diversity called Space-Time Coding. The transmit diversity is compared with Maximal-Ratio Combining receiver diversity. The evaluation was done in simulation developed in Matlab; the simulations show drastic improvement when using the aforementioned techniques, particularly diversity.

DTIC

Antennas; Broadband; Communication Networks; Reliability Analysis

20050200892 Naval Postgraduate School, Monterey, CA USA

Investigations of Parametric Excitation in Physical Systems

Janssen, Michael T.; Jun. 2005; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435509; No Copyright; Avail: Defense Technical Information Center (DTIC)

Parametric excitation can occur when the value of a parameter of an oscillator is modulated at twice the natural frequency of the oscillator. The response grows exponentially and is only limited by a nonlinearity of the system, so large response amplitudes typically occur. However, there is no response unless the parametric drive amplitude is above a threshold value that is dictated by the damping. We investigate parametric excitation in three physical systems. The first involves an acoustic standing wave in a pipe that is driven by a piston at one end. An analysis shows that parametric excitation is not feasible in this system unless one uses a very large-excursion piston (for example, from an aircraft engine). The second system is an inductor-capacitor circuit which can undergo oscillations of the current. An analysis of capacitance modulation with a bank of alternate rotating and stationary parallel plates shows that parametric excitation would be very difficult to achieve. Finally, we describe the construction of a torsional oscillator whose length is modulated. Parametric excitation is successfully demonstrated in this system. A comparison of data to predictions of the standard theory of parametric excitation reveals significant deviations.

DTIC

Excitation; Sound Waves

20050200916 Defense Science Board, Washington, DC USA

Report of the Defense Science Board Task Force on High Performance Microchip Supply

Feb. 2005; 118 pp.; In English

Report No.(s): AD-A435563; No Copyright; Avail: Defense Technical Information Center (DTIC)

The microelectronics industry, supplier of hardware capability that underlies much of America's modern military leadership technology, is well into a profound restructuring leading to horizontal consolidation replacing the past vertically integrated company structure. One unintended result of this otherwise sound industry change is the relocation of critical microelectronics manufacturing capabilities from the USA to countries with lower cost capital and operating environments. Trustworthiness and supply assurance for components used in critical military and infrastructure applications are casualties of the migration. Further, while not the focus of the study per se, the U.S. national technological leadership may be increasingly challenged by these changing industry dynamics; this poses long term national economic security concerns.

DTIC

Chips (Electronics); Human Performance; Microelectronics; Military Technology; Organizations; Tasks

20050200924 Naval Postgraduate School, Monterey, CA USA

Optical Detection Using Four-Layer Semiconductor Structures

Moore, David A.; Jun. 2005; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435573; No Copyright; Avail: Defense Technical Information Center (DTIC)

The application of a thyristor (a four-layer P1-N1-P2-N2 semiconductor structure) as an optical detector is explored. Based on laboratory experiments which demonstrated that this device produces a pulse-mode output to incident light, the thyristor is investigated by comparing the existing theory of static forward-biased operation to simulation results obtained using ATLAS by Silvaco, Inc. The results include identification of the holding point on the IV curve by simulating the junction potential across each junction as a function of current, and demonstration that impact ionization is not a critical factor in thyristor operation. A series of simulations were performed which show that the thyristor can be optimized for use as a detector by decreasing the emitter efficiencies by decreasing the doping in the P1 and N2 layers, or by increasing the doping in the P2 layer; the switching voltage can be controlled by selecting the doping and thickness of the N1 layer. A detector device was designed to allow further testing of the thyristor detector using the ABN CMOS process from AMI semiconductor via the

MOSIS service. The design of this device is discussed and simulated IV curves are presented.
DTIC

Detection; Optical Measurement; Optical Measuring Instruments; Semiconductor Devices

20050200963 Space and Naval Warfare Systems Center, San Diego, CA USA

DC and RF Characterization of Laser Annealed Metal-Gate SOI CMOS Field-Effect Transistors

Lu, Ryan P.; Offord, Bruce W.; Popp, Jeremy D.; Ramirez, Ayax D.; Rowland, Jason F.; Russell, Stephen D.; Apr. 2005; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435649; SSC/SD-TD-3196; No Copyright; Avail: Defense Technical Information Center (DTIC)

The conventional polysilicon gate in a MOSFET has been replaced by an aluminum metal gate which offers higher RF performance through the reduction of gate resistance. Pulsed excimer laser annealing of the source and drain was then used to avoid conventional furnace annealing that would melt the aluminum metal gate. CMOS field-effect transistors utilizing metal gates were fabricated in Silicon-on-Insulator (SOI) technology down to 0.25 micron gate lengths. The DC characteristics of devices with 10-micron gate lengths were consistently well-behaved. The 0.25 micron devices were found to be more sensitive to the laser energy that showed up in the DC measurements in threshold voltage variations and larger leakage currents in the subthreshold characteristics. At higher laser fluences, Technology Computer-Aided Design (TCAD) simulations show excessive lateral diffusion, explaining the observed effects. RF results of the drawn 0.25 micron metal-gate devices have an $F(t)$ and $F(max)$ of 25 GHz and 60 GHz, respectively. Similar devices with polysilicon gates were fabricated and characterized for comparison. RF results of the drawn 0.25 micron polysilicon gate devices have an $F(t)$ and $F(max)$ of 34 GHz and 7 GHz, respectively. This device processing advance offers a deeply scalable technology for future 'system-on-a-chip' applications.
DTIC

Annealing; CMOS; Direct Current; Electromagnetic Measurement; Field Effect Transistors; Lasers; Radio Frequencies; Semiconductors (Materials)

20050200979 Naval Postgraduate School, Monterey, CA USA

Closed Loop Control of a Cascaded Multi-Level Converter to Minimize Harmonic Distortion

Souhan, Brian E.; Jun. 2005; 105 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435676; No Copyright; Avail: Defense Technical Information Center (DTIC)

As the USA Navy moves toward the all-electric ship, the need for a robust, high fidelity inverter for propulsion motors becomes mandatory. Military vessels require high power converters capable of producing nearly sinusoidal outputs to prevent torque pulsations and electrical noise that can compromise the mission location. This thesis presents a hybrid pulse-width-modulated controller for a 3x3 Cascaded Multi-Level Converter (CMLC). Ancillary results include a simple technique for extracting the reference sine wave from an independent bulk converter and implementing a synchronization technique that coordinates a space vector modulation controller with the switching pattern of a bulk inverter. The algorithms were tested on CMLC hardware that resides in the Naval Postgraduate School Power Systems Laboratory, and the results were compared with a sine-triangle pulse width modulation algorithm. The controller and converter were used to power a quarter-horsepower three-phase induction motor.

DTIC

Distortion; Feedback Control; Harmonics; Sine Waves

20050201011 Space and Naval Warfare Systems Center, San Diego, CA USA

Nanosecond Thermal Processing for Self-Aligned Silicon-on-Insulator Technology

Ramirez, A. D.; Offord, B. W.; Popp, J. D.; Russell, S. D.; Rowland, J. F.; Apr. 2005; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435738; No Copyright; Avail: Defense Technical Information Center (DTIC)

Future radar and communications systems will have the need to use CMOS integrated circuits to provide increased analog and digital functions. Conventional CMOS technology has been locked into designing processes around polysilicon gate material because of the need for self-alignment. Low-resistance metal gates are superior for high-speed devices. However, their low melting point prevented their use in a self-aligned structure that experiences high-temperature processing (~ 700 degrees C). Silicon-on-Insulator (SOI) technology, non-refractory metal gates, and nanosecond laser processing were used to fabricate a self-aligned structure. These techniques will allow further scaling of CMOS devices and enable mixed-mode devices to be integrated on the same substrate. The laser is used to rapidly, on the order of nanoseconds, melt and redistribute the implanted dopants for the order of nanoseconds, melt and redistribute the implanted dopants for the source and drain with

minimal lateral diffusion, which lowers parasitic gate to drain and source overlap capacitance. Gate resistance can be lowered by at least an order of magnitude and optimal threshold control of pMOS and nMOS devices can be achieved by using an aluminum metal gate instead of a polysilicon gate. This process allows high-performance, low-power digital technology to be integrated with high F(max) low-noise RF devices.

DTIC

Integrated Circuits; Semiconductor Devices; Silicon; SOI (Semiconductors)

20050201017 Maryland Univ., College Park, MD USA

On-Chip Hardware for Cell Monitoring: Contact Imaging and Notch Filtering

Abshire, Pamela; Smela, Elisabeth; Shapiro, Benjamin; Jul. 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0449

Report No.(s): AD-A435748; AFRL-SR-AR-TR-05-0281; No Copyright; Avail: Defense Technical Information Center (DTIC)

The cell canary system will combine live bio-engineered cells with on-chip MEMS hardware. It will function by monitoring the response of many live cells to an external environment. Each cell, or cell colony, will be bio-engineered to fluoresce in response to a specific external pathogen. The fluorescence will occur through a FRET interaction with a quantum dot that labels a component of the pathway. If the cell or cell colony dies due to the presence of its target pathogen, then it will fluoresce as it dies; if the cell or cell colony dies due to other factors, then it will not fluoresce. The system will therefore act as a 'cell canary' system for specific, low-false-positive detection of pathogens. Our goal here is to demonstrate proof-of-concept for the on-chip fluorescence detection portion of the project.

DTIC

Imaging Techniques; Notches

20050201038 Arizona Univ., Tucson, AZ USA

Metamaterial-Based Patch Antennas and Adaptive Rectifying Circuits for High Power Rectenna Applications

Ziolkowski, Richard W.; Jan. 2005; 17 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0320

Report No.(s): AD-A435786; No Copyright; Avail: CASI; [A03](#), Hardcopy

The efforts of this project considered two technological aspects of rectennas systems. One technology that was emphasized power-adaptive- rectifying circuits (PARCs). If a rectenna system is to be integrated into an autonomous vehicle system and fed by a stationary microwave source, the electromagnetic power incident on the rectenna will vary with the distance between - the source and the rectenna. Consequently, the output power from the rectenna could vary dramatically with small changes in the location of the rectenna system. To mitigate these input power effects, we considered a prototype PARC design at 1MHz and a corresponding RF PARC design at 2.45 GHz in the ISM band. As proposed, several power adaptive rectifying circuits were designed, built, and tested. Several metamaterial-based electrically small antennas were also considered during the project duration. These efforts included an integrated antenna- artificial magnetic conductor (AMC) system and a metamaterial-based efficient electrically small dipole antenna. An optimal design of a printed dipole antenna integrated with an AMC block having no ground plane was achieved. An efficient electrically small antenna was achieved by surrounding a center-fed dipole antenna with an ENG (epsilon negative) metamaterial spherical shell and a coax-fed monopole antenna with an ENG metamaterial hemispherical shell.

DTIC

Antennas; Circuits; Electromagnetic Properties; Magnetic Properties; Patch Antennas; Rectennas; Rectification

20050201045 Pennsylvania State Univ., University Park, PA USA

Provide the FORA for ONR Sponsored NPAL 04 Experiment

Preston, John R.; Becker, Kyle M.; Jul. 2005; 5 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0011

Report No.(s): AD-A435795; No Copyright; Avail: CASI; [A01](#), Hardcopy

The ONR Five Octave-Research Array (FORA) was employed as the primary receive system for the Basin Acoustic Seamount Scattering Experiment (BASSEX) in Sept-Oct 2004 Operating the the deep North Pacific this was the first deep water application of the FORA. Array operation and performance are described along with an assessment of data quality for

the sea trail. The array proved to be a versatile tool for this test and for future work.

DTIC

Deep Water; Ocean Surface; Sound Transmission; Underwater Acoustics; Water Waves

20050201589 Naval Undersea Warfare Center, Newport, RI USA

Antenna Articulation Apparatus for a Submersible Device, and Method of Use

Miller, Grant M., Inventor; Dec. 2004; 17 pp.; In English

Report No.(s): AD-D020204; No Copyright; Avail: CASI; [A03](#), Hardcopy

An antenna articulation apparatus and method of use for a submersible device is provided. The apparatus includes a body having a cavity formed at an external surface. A bladder containing a core material is arranged within the cavity. The core material contracts and expands the bladder depending upon a pressure that surrounds the bladder. An antenna operatively connected with the bladder and articulates between a retracted position and a deployed position as the bladder contracts and expands.

DTIC

Antennas; Buys

20050201591 Department of the Navy, Washington, DC USA

Mosaic Process for the Fabrication of an Acoustic Transducer Array

Jun. 2005; 15 pp.; In English

Report No.(s): AD-D020206; No Copyright; Avail: CASI; [A03](#), Hardcopy

This patent application discloses a method that involves establishing the performance level of a proposed acoustic transducer array. Deriving a geometric shape for the array based on the established performance level. Selecting piezoceramic materials based on considerations related to the performance level and derived geometry. Forming small primary shape of the selected piezoceramic materials for use as the basic elements of the larger derived geometric shape of the array. Arranging the basic elements into a mosaic of the larger derived geometric shape. Filling the interstices between the basic elements with urethane to bind the mosaic of basic elements thereby fabricating the completed piezoceramic transducer array.

DTIC

Acoustic Measurement; Arrays; Electroacoustic Transducers; Fabrication; Mosaics; Patent Applications; Sound Transducers

20050201593 Department of the Navy, Washington, DC USA

Natural Fiber Span Reflectometer Providing a Virtual Signal Sensing Array Capability

Payton, Robert M., Inventor; Jun. 2005; 94 pp.; In English

Report No.(s): AD-D020208; No Copyright; Avail: CASI; [A05](#), Hardcopy

The present invention relates generally to the field of time-domain reflectometers. More specifically, it relates to such reflectometers which are a part of a photonic system application in which the object of the reflectometry is a span of fiber which has an interrogation signal launch end and a remote end. The invention enables the provision of a linear array of virtual sensors along the span. One particular type of application toward which the invention is directed is an acoustic security alarm system in which the span serves as a perimeter intrusion monitoring line.

DTIC

Detection; Linear Arrays; Patent Applications; Reflectometers; Signal Processing

20050201597 Department of the Navy, Washington, DC USA

Direct Reacting Anolyte-Catholyte Fuel Cell for Hybrid Energy Sources

Medeiros, Maria G., Inventor; Jul. 2005; 18 pp.; In English

Report No.(s): AD-D020212; No Copyright; Avail: CASI; [A03](#), Hardcopy

This patent application discloses a fuel cell and a method for using the fuel cell to make electricity, in which the fuel cell has an anode half-cell having an electrocatalytic anode and a liquid anolyte that is substantially isopropanol dissolved in seawater. The fuel cell has a cathode half-cell having an electrocatalytic cathode and a liquid catholyte that is substantially hydrogen peroxide dissolved in slightly acidic seawater. The half-cells share a common proton exchange membrane. When the anode and cathode are in electrical connection the isopropanol is oxidized to carbon dioxide, which is fugitive, and the hydrogen peroxide is reduced to water. In the method, the anolyte and the catholyte, which are in effect the fuel of the fuel

cell, are metered and re-circulated as needed to produce the necessary electrical power. The electrocatalytic electrodes are typically comprised of palladium and iridium alloys.

DTIC

Anodes; Anolytes; Cathodes; Catholytes; Electrocatalysts; Fuel Cells; Patent Applications

20050201640 NASA Glenn Research Center, Cleveland, OH, USA

Intelligent dc-dc Converter Technology Developed and Tested

Button, Robert M.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center and the Cleveland State University have developed a digitally controlled dc-dc converter to research the benefits of flexible, digital control on power electronics and systems. Initial research and testing has shown that conventional dc-dc converters can benefit from improved performance by using digital-signal processors and nonlinear control algorithms.

Derived from text

Algorithms; Voltage Converters (DC to DC); Signal Processing; Digital Systems

20050201660 NASA Glenn Research Center, Cleveland, OH, USA

Solid-Body Fuse Developed for High- Voltage Space Power Missions

Dolce, James L.; Baez, Anastacio N.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

AEM Incorporated has completed the development, under a NASA Glenn Research Center contract, of a solid-body fuse for high-voltage power systems of satellites and spacecraft systems. High-reliability fuses presently defined by MIL-PRF-23419 do not meet the increased voltage and amperage requirements for the next generation of spacecraft. Solid-body fuses exhibit electrical and mechanical attributes that enable these fuses to perform reliably in the vacuum and high-vibration and -shock environments typically present in spacecraft applications. The construction and screening techniques for solid-body fuses described by MIL-PRF-23419/12 offer an excellent roadmap for the development of high-voltage solid-body fuses.

Derived from text

Circuit Breakers; High Voltages; Power Supplies; Space Missions; Electric Potential

20050201889 NASA Glenn Research Center, Cleveland, OH, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA, NASA Langley Research Center, Hampton, VA, USA, Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Cryogenic Electronics Being Developed for Space Operation

Patterson, Richard L.; Hammoud, Ahmad; Gerber, Scott S.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Planetary exploration missions and deep space probes require electrical power management and control systems that can operate efficiently and reliably in very low temperature environments. Presently, spacecraft operating in the cold environment of deep space carry a large number of radioisotope heating units to maintain the surrounding temperature of the onboard electronics at approximately 20 C. Electronics capable of operation at cryogenic temperatures would not only tolerate the hostile environment of deep space but also reduce system size and weight by eliminating or reducing the radioisotope heating units and their associate structures. Thereby, such electronics would reduce system development as well as launch costs. In addition, power electronic circuits designed for operation at low temperatures are expected to result in more efficient systems than those at room temperature. This improvement results because semiconductor and dielectric materials have better behavior and tolerance in their electrical and thermal properties at low temperatures. The Low Temperature Electronics Program at the NASA Glenn Research Center is focusing on the research and development of electrical components, circuits, and systems suitable for applications in the aerospace environment and in deep space exploration missions. Research is being conducted on devices and systems for reliable use down to cryogenic temperatures. Some of the commercial off-the-shelf as well as developed components that are being characterized include semiconductor switching devices, resistors, magnetics, and capacitors. Semiconductor devices and integrated circuits including digital-to-analog and analog-to-digital converters, dc-dc converters, operational amplifiers, and oscillators are also being investigated for potential use in low-temperature applications. For example, the output response of an advanced oscillator at room temperature and at -190 C is shown. Most oscillators can operate at temperatures down to only -55 C. It can be seen that, for this oscillator, the low temperature of -196 C changed the leading and trailing edges of the oscillator pulses by producing overshoot. The research and development efforts performed under the Low Temperature Electronics Program at Glenn are being carried out through collaboration with other Government

agencies, industrial and aerospace companies, and academia. The program supports missions as well as technology development efforts at NASA's Goddard Space Flight Center and Langley Research Center, and the Jet Propulsion Laboratory.

Author

Cryogenics; Electronics; Spacecraft Performance

20050201893 NASA Glenn Research Center, Cleveland, OH, USA, Michigan Univ., MI, USA

High-Power, High-Frequency Si-Based (SiGe) Transistors Developed

Ponchak, George E.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Future NASA, DOD, and commercial products will require electronic circuits that have greater functionality and versatility but occupy less space and cost less money to build and integrate than current products. System on a Chip (SOAC), a single semiconductor substrate containing circuits that perform many functions or containing an entire system, is widely recognized as the best technology for achieving low-cost, small-sized systems. Thus, a circuit technology is required that can gather, process, store, and transmit data or communications. Since silicon-integrated circuits are already used for data processing and storage and the infrastructure that supports silicon circuit fabrication is very large, it is sensible to develop communication circuits on silicon so that all the system functions can be integrated onto a single wafer. Until recently, silicon integrated circuits did not function well at the frequencies required for wireless or microwave communications, but with the introduction of small amounts of germanium into the silicon to make silicon-germanium (SiGe) transistors, silicon-based communication circuits are possible. Although microwave-frequency SiGe circuits have been demonstrated, there has been difficulty in obtaining the high power from their transistors that is required for the amplifiers of a transmitter, and many researchers have thought that this could not be done. The NASA Glenn Research Center and collaborators at the University of Michigan have developed SiGe transistors and amplifiers with state-of-the-art output power at microwave frequencies from 8 to 20 GHz. These transistors are fabricated using standard silicon processing and may be integrated with CMOS integrated circuits on a single chip. A scanning electron microscope image of a typical SiGe heterojunction bipolar transistor is shown in the preceding photomicrograph. This transistor achieved a record output power of 550 mW and an associated power-added efficiency of 33 percent at 8.4 GHz, as shown. Record performance was also demonstrated at 12.6 and 18 GHz. Developers have combined these state-of-the-art transistors with transmission lines and micromachined passive circuit components, such as inductors and capacitors, to build multistage amplifiers. Currently, a 1-W, 8.4-GHz power amplifier is being built for NASA deep space communication architectures.

Author

Germanium; Silicon Transistors; Transistors; Fabrication; High Frequencies; Power Amplifiers

20050201894 NASA Glenn Research Center, Cleveland, OH, USA

Low-Loss, High-Isolation Microwave Microelectromechanical Systems (MEMS) Switches Being Developed

Ponchak, George E.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Switches, electrical components that either permit or prevent the flow of electricity, are the most important and widely used electrical devices in integrated circuits. In microwave systems, switches are required for switching between the transmitter and receiver; in communication systems, they are needed for phase shifters in phased-array antennas, for radar and communication systems, and for the new class of digital or software definable radios. Ideally, switches would be lossless devices that did not depend on the electrical signal's frequency or power, and they would not consume electrical power to change from OFF to ON or to maintain one of these two states. Reality is quite different, especially at microwave frequencies. Typical switches in microwave integrated circuits are pin diodes or gallium arsenide (GaAs) field-effect transistors that are nonlinear, with characteristics that depend on the power of the signal. In addition, they are frequency-dependent, lossy, and require electrical power to maintain a certain state. A new type of component has been developed that overcomes most of these technical difficulties. Microelectromechanical (MEMS) switches rely on mechanical movement as a response to an applied electrical force to either transmit or reflect electrical signal power. The NASA Glenn Research Center has been actively developing MEMS for microwave applications for over the last 5 years. Complete fabrication procedures have been developed so that the moving parts of the switch can be released with near 100-percent yield. Moreover, the switches fabricated at Glenn have demonstrated state-of-the-art performance. A typical MEMS switch is shown. The switch extends over the signal and ground lines of a finite ground coplanar waveguide, a commonly used microwave transmission line. In the state shown, the switch is in the UP state and all the microwave power traveling along the transmission line proceeds unimpeded. When a potential difference is applied between the cantilever and the transmission line, the cantilever is pulled downward until it connects the signal line to the ground planes, creating a short circuit. In this state, all the microwave power is reflected. The

graph shows the measured performance of the switch, which has less than 0.1 dB of insertion loss and greater than 30dB of isolation. These switches consume negligible electrical power and are extremely linear. Additional research is required to address reliability and to increase the switching speed.

Author

Microelectromechanical Systems; Microwave Circuits; Integrated Circuits; Electric Switches; Fabrication

20050201924 Princeton Univ., NJ USA

Space Charge Saturated Sheath Regime and Electron Temperature Saturation in Hall Thrusters

Raitses, Y.; Staack, D.; Smirnov, A.; Fisch, N. J.; Mar. 2005; 52 pp.; In English

Report No.(s): DE2005-837855; PPPL-4058; No Copyright; Avail: Department of Energy Information Bridge

Secondary electron emission in Hall thrusters is predicted to lead to space charge saturated wall sheaths resulting in enhanced power losses in the thruster channel. Analysis of experimentally obtained electron-wall collision frequency suggests that the electron temperature saturation, which occurs at high discharge voltages, appears to be caused by a decrease of the Joule heating rather than by the enhancement of the electron energy loss at the walls due to a strong secondary electron emission.

NTIS

Electron Emission; Electron Energy; Hall Thrusters; Sheaths; Space Charge

20050201993 Lawrence Livermore National Lab., Livermore, CA USA

Heterodyne Mask Blank Defect Detection LDRD Project Final Report

Johnson, M. A.; Sommargren, G. E.; Feb. 04, 2000; 30 pp.; In English

Report No.(s): DE2005-15013535; UCRL-ID-137883; No Copyright; Avail: Department of Energy Information Bridge

Mask blanks are the substrates that hold the master patterns for integrated circuits. Integrated circuits are semiconductor devices, such as microprocessors, dynamic random access memory (DRAMs), and application specific integrated circuits (ASICs) that are central to the computer, communication, and electronics industries. These devices are fabricated using a set of master patterns that are sequentially imaged onto light-sensitive coated silicon wafers and processed to form thin layers of insulating and conductive materials on top of the wafer. These materials form electrical paths and transistors that control the flow of electricity through the device.

NTIS

Defects; Detection; Heterodyning; Integrated Circuits; Masks

20050202021 Missouri Univ., Rolla, MO, USA

AC/DC Power Systems with Applications for future Lunar/Mars base and Crew Exploration Vehicle

Chowdhury, Badrul H.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 4-1 - 4-17; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

ABSTRACT The Power Systems branch at JSC faces a number of complex issues as it readies itself for the President's initiative on future space exploration beyond low earth orbit. Some of these preliminary issues - those dealing with electric power generation and distribution on board Mars-bound vehicle and that on Lunar and Martian surface may be summarized as follows: Type of prime mover - Because solar power may not be readily available on parts of the Lunar/Mars surface and also during the long duration flight to Mars, the primary source of power will most likely be nuclear power (Uranium fuel rods) with a secondary source of fuel cell (Hydrogen supply). The electric power generation source - With nuclear power being the main prime mover, the electric power generation source will most likely be an ac generator at a yet to be determined frequency. Thus, a critical issue is whether the generator should generate at constant or variable frequency. This will decide what type of generator to use - whether it is a synchronous machine, an asynchronous induction machine or a switched reluctance machine. The type of power distribution system - the distribution frequency, number of wires (3- wire, 4-wire or higher), and ac/dc hybridization. Building redundancy and fault tolerance in the generation and distribution sub-systems so that the system is safe; provides 100% availability to critical loads; continues to operate even with faulted sub-systems; and requires minimal maintenance. This report describes results of a summer faculty fellowship spent in the Power Systems Branch with the specific aim of investigating some of the lessons learned in electric power generation and usage from the terrestrial power systems industry, the aerospace industry as well as NASA's on-going missions so as to recommend novel surface and vehicle-based power systems architectures in support of future space exploration initiatives. A hybrid ac/dc architecture with source side and load side redundancies and including emergency generators on both ac and dc sides is proposed. The

generation frequency is 400 Hz mostly because of the technology maturity at this frequency in the aerospace industry. Power will be distributed to several ac load distribution buses through solid state variable speed, constant frequency converters on the ac side. A segmented dc ring bus supplied from ac/dc converters and with the capability of connecting/disconnecting the segments will supply power to multiple dc load distribution buses. The system will have the capability of reverse flow from dc to ac side in the case of an extreme emergency on the main ac generation side.

Author

AC Generators; Electric Power Supplies; Electric Generators; Aerospace Industry; Frequency Converters

20050202090 QSS Group, Inc., Cleveland, OH, USA

Design Considerations for High Temperature Power Inductors

Niedra, Janis M.; July 2005; 22 pp.; In English; Second International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): NAS3-00145; NAS3-98008; WBS 220319-20-N1

Report No.(s): NASA/CR-2005-213354; E-14822; AIAA Paper 2004-5748; No Copyright; Avail: CASI; [A03](#), Hardcopy

A uniform B-field approximation model is used to develop design formulas for single-layer wound, toroidal core, ac power inductors that must handle a specified current. Such a geometry is well suited for high temperature, high frequency inductors, where removal of heat from the core becomes critical. Explicit expressions are derived for core radii, core and winding volumes, winding turns and core permeability as functions of a dimensional scaling ratio (S). A limit on the maximum allowed core B-field leads to the result that the minimum core volume is proportional to the permeability, which has a lower bound. Plots versus S are provided for a specific case, to show that good designs can be picked in the overlap regions around the minima in mass and overall size, where the mass and size are relatively flat. Data to 250 C are presented for an MPP core based inductor to show that a quasi-linear, high temperature inductor can be constructed with available materials. A similar development is applied to a toroidal air-core geometry, showing that for the same ratings, such an inductor is considerably bigger and more massive, at least in the single-layer version.

Author

High Temperature; Inductors; Magnetic Cores; Approximation; Mathematical Models; Electrical Engineering

20050203656 NASA Glenn Research Center, Cleveland, OH, USA

Broadband, Low-Loss Phase Shifters Based on Thin Ferroelectric Films

Romanofsky, Robert; [2004]; 1 pp.; In English; IEEE Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

Several different types of microwave transmission line phase shifters based on thin ferroelectric films have been developed at the NASA Glenn Research Center. These include a series of coupled microstrip lines, slotline incorporating Marchand baluns, odd-mode coplanar strips, and hybrid devices incorporating a switch to toggle the output termination between an open and virtual short circuit. A review of the theory of operation of each of these devices will be presented along with measured performance. Also, devices of the first variety have been subjected to total dose (proton) radiation exposure using a 200 MeV beam energy with a total dose up to nearly 1 kRad (Si). Results of these radiation tests will be discussed.

Author

Broadband; Ferroelectricity; Thin Films; Phase Shift; Microwave Transmission

20050203687 NASA Glenn Research Center, Cleveland, OH, USA, Naval Sea Systems Command, Crane, IN, USA

Individual Pressure Vessel (PV) and Common Pressure Vessel (CPV) Nickel-Hydrogen Battery Performance Under LEO Cycling Conditions

Miller, Thomas B.; Lewis, Harlan L.; [2004]; 1 pp.; In English; Aerospace Corporation Space Power Workshop 2004, 19-22 Apr. 2004, Manhattan Beach, CA, USA

Contract(s)/Grant(s): NASA Order C-30008-K; No Copyright; Avail: Other Sources; Abstract Only

LEO life cycle testing of Individual Pressure Vessel (PV) and Common Pressure Vessel (CPV) nickel-hydrogen cell packs have been sponsored by the NASA Aerospace Flight Battery Program. The cell packs have cycled under both 35% and 60% depth-of-discharge and temperature conditions of -5 C and +10 C. The packs have been on test since as early as 1992 and have generated a substantial database. This report will provide insight into performance trends as a function of the specific cell configuration and manufacturer for eight separate nickel-hydrogen battery cell packs.

Author

Electric Batteries; Nickel Hydrogen Batteries; Pressure Vessels; Life (Durability)

20050203777 Naval Research Lab., Washington, DC, USA

Modeling Solar Cell Degradation in Space: A Comparison of the JPL and NRL Methods

Summers, Geoffrey P.; Messenger, Scott R.; Walters, Robert J.; Burke, Edward A.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 1-12; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper presents viewgraphs on the Modeling of Solar Cell Degradation in Space with a comparison of JPL and NRL Methods. The topics include: 1) The Problem; 2) The JPL Equivalent Fluence Method; 3) The NRL Displacement Damage Dose Method; 4) Comparison of Results; and 5) Issues

CASI

Degradation; Solar Cells; Models; Aerospace Environments

20050203789 TECSTAR, Inc., City of Industry, CA, USA

TECSTAR'S Next Generation Cascade. Solar Cell Improvements: A Monolithic Integral Diode and New Middle Cell Formation

Kilmer, Louis C.; Chu, Charlie; Yeh, Milton; Iles, Peter; Chiang, P. K.; Ho, Frank; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 83-93; In English; See also 20050203753; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

TECSTAR has developed several major improvements to its Commercial Cascade multijunction solar cell throughout the early part of 1999, that when combined, increase the efficiency of the solar cells by 4.3% at beginning-of-life (BOL) and 10.4% at the end-of-life (EOL). TECSTAR fully qualified and began production of its standard Commercial Cascade multijunction solar cell in mid-1998 and early production achieved average efficiencies around 21.9%. By the end of 1998, this was improved to 23.0% and the path to even higher efficiencies was established and was aggressively pursued such that 24.0% fully reverse bias protected, radiation hard solar cells will be space qualified and available by the end of 1999.

Author

Solar Cells; Junction Diodes; Cascade Control; Integrated Circuits

20050203790 Emcore Corp., Albuquerque, NM, USA

Development, Space Qualification, and Production of High-Efficiency Large-Area InGaP/GaAs Dual-Junction Solar Cells on Ge at Emcore Photovoltaics (EPV)

Fatemi, Navid S.; Hou, Hong Q.; Sharps, Paul R.; Martin, Paul M.; Hammons, B. E.; Spadafora, Frank; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 94-108; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper describes the development, space qualification, and production of high-efficiency dual-junction InGaP/GaAs solar cells grown on Ge substrates, at Emcore Photovoltaics (EPV). The fully automated EPV manufacturing facility in Albuquerque, New Mexico was built in late 1998 from ground up for volume production of multi-junction solar cells for space power. High-efficiency in InGaP/GaAs dual-junction solar cells, with n-on-p polarity, were space qualified and in volume production in the middle of 1999. All the solar cells were designed for the best end-of-life (EOL) performance. The power remaining factor after irradiation with 1-MeV electrons at a fluence of 1×10^{15} e per square centimeter is 0.83. The minimum average conversion efficiency of the large-area (27.5 square centimeters) solar cell currently in production is 23.0% (AMO, 135.3 milliwatts per square centimeter, 28 C), producing about 0.86 watts of power per cell. The highest efficiency from this dual-junction solar cell (on Ge) measured to date is 24.1%. We will also present a product roadmap for the development of ultra-high-efficiency (greater than 30%) solar cells

Author

Gallium Arsenides; Gallium Phosphides; Indium Phosphides; Solar Cells; Germanium; Photovoltaic Effect; Quantum Efficiency

20050203863 NASA Glenn Research Center, Cleveland, OH, USA

High Mobility SiGe/Si n-Type Structures and Field Effect Transistors on Sapphire Substrates

Alterovitz, Samuel A.; Ponchak, George E.; Mueller, Carl H.; Croke, Edward T.; March 10, 2004; 2 pp.; In English; 5th Topical Meeting on Silicon Monolithic Integrated Circuits in RF Systems, 8-10 Sep. 2004, Atlanta, GA, USA

Contract(s)/Grant(s): 22-090-20-C1; Copyright; Avail: CASI; [A01](#), Hardcopy

SiGe/Si n-type modulation doped field effect transistors (MODFETs) fabricated on sapphire substrates have been characterized at microwave frequencies for the first time. The highest measured room temperature electron mobility is 1380

sq cm/V-sec at a carrier density of 1.8×10^{12} /sq cm for a MODFET structure, and 900 sq cm/V-sec at a carrier density of 1.3×10^{10} /sq cm for a phosphorus ion implanted sample. A two finger, 2 x 200 micron gate n-MODFET has a peak transconductance of 37 mS/mm at a drain to source voltage of 2.5 V and a transducer gain of 6.4 dB at 1 GHz.

Author

Modfets; N-Type Semiconductors; Sps (Semiconductors); Electron Mobility; Silicon Compounds; Germanium Compounds

20050203939 Stevens Inst. of Tech., Hoboken, NJ, USA

Performance Comparison of Two Delay Sensitive Multipath Routing Schemes in Ad Hoc Directional Networks

Li, Yang; Man, Hong; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Exploiting directional antennae in Ad hoc networks has become an active research topic because of the potential capacity increase through spatial reuse. Current research efforts have only considered applying conventional ad hoc routing protocols (e.g. DSR, AODV) on these type of networks. The routing schemes are typically based on the shortest path metric. However such a routing approach often suffers long transmission delay and frequent link breakage in directional networks. This is caused by a unique feature of directional transmission commonly known as node 'deafness' [1]. To address this problem, we proposed a multi-path routing scheme which focuses more on minimizing per-hop delays instead of route length. In this paper, two implementations of this scheme based on AODV and DSR protocols are presented; a performance comparison between these protocols is provided. Simulation results demonstrate a clear performance improvement by using such a delay-sensitive routing approach for directional ad hoc networks.

Author

Multipath Transmission; Protocol (Computers); Directional Antennas

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FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20050199448 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Novel Shapes of Miscible Interfaces Observed

Balasubramaniam, Ramaswamy; Rashidnia, Nasser; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The dynamics of miscible displacements in a cylindrical tube are being investigated experimentally and numerically, with a view to understand the complex processes that occur, for example, in enhanced oil recovery, hydrology, and filtration. We have observed complex shapes of the interface between two liquids that mix with each other when the less viscous liquid is displaced by the more viscous one in a tube. A less viscous fluid that displaces a more viscous fluid is known to propagate in the form of a 'finger,' and a flight experiment proposed by Maxworthy et al. to investigate the miscible-interface dynamics is currently being developed by NASA. From the current theory of miscible displacements, which was developed for a porous medium satisfying Darcy's law, it can be shown that in the absence of gravity the interface between the fluids is destabilized and thus susceptible to fingering only when a more viscous fluid is displaced by a less viscous one. Therefore, if the interface is initially flat and the more viscous fluid displaces the less viscous fluid, the interface ought to be stable and remain flat. However, numerical simulations by Chen and Meiburg for such displacement in a cylindrical tube show that the interface is unstable and a finger of the more viscous fluid is indeed formed. Preliminary experiments performed at the NASA Glenn Research Center show that not only can fingering occur when the more viscous fluid displaces a less viscous one in a cylindrical tube, but also that under certain conditions the advancing finger achieves a sinuous or snakelike shape. These experiments were performed using silicone oils in a vertical pipette of small diameter. In the initial configuration, the more viscous fluid rested on top of the less viscous one, and the interface was nominally flat. A dye was added to the upper liquid for ease of observation of the interface between the fluids. The flow was initiated by draining the lower fluid from the bottom of the pipette, at speeds less than 0.1 mm/sec.

Author

Cylindrical Bodies; Displacement; Experimentation; Numerical Analysis; Viscous Fluids

20050199449 NASA Glenn Research Center, Cleveland, OH, USA

Gas-Liquid Two-Phase Flows Through Packed Bed Reactors in Microgravity

Motil, Brian J.; Balakotaiah, Vemuri; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The simultaneous flow of gas and liquid through a fixed bed of particles occurs in many unit operations of interest to the designers of space-based as well as terrestrial equipment. Examples include separation columns, gas-liquid reactors, humidification, drying, extraction, and leaching. These operations are critical to a wide variety of industries such as petroleum, pharmaceutical, mining, biological, and chemical. NASA recognizes that similar operations will need to be performed in space and on planetary bodies such as Mars if we are to achieve our goals of human exploration and the development of space. The goal of this research is to understand how to apply our current understanding of two-phase fluid flow through fixed-bed reactors to zero- or partial-gravity environments. Previous experiments by NASA have shown that reactors designed to work on Earth do not necessarily function in a similar manner in space. Two experiments, the Water Processor Assembly and the Volatile Removal Assembly have encountered difficulties in predicting and controlling the distribution of the phases (a crucial element in the operation of this type of reactor) as well as the overall pressure drop.

Derived from text

Crude Oil; Fluid Flow; Liquid-Gas Mixtures; Two Phase Flow

20050199450 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

How Does a Liquid Wet a Solid? Hydrodynamics of Dynamic Contact Angles

Rame, Enrique; Research and Technology 2000; March 2001; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A contact line is defined at the intersection of a solid surface with the interface between two immiscible fluids. When one fluid displaces another immiscible fluid along a solid surface, the process is called dynamic wetting and a 'moving' contact line (one whose position relative to the solid changes in time) often appears. The physics of dynamic wetting controls such natural and industrial processes as spraying of paints and insecticides, dishwashing, film formation and rupture in the eye and in the alveoli, application of coatings, printing, drying and imbibition of fibrous materials, oil recovery from porous rocks, and microfluidics.

Derived from text

Hydrodynamics; Wetting; Solid Surfaces; Liquid Phases

20050199658 Virginia Univ., Charlottesville, VA, USA

Planar Laser-Induced Iodine Fluorescence Measurements in Rarefied Hypersonic Flow

Cecil, Eric; McDaniel, James C.; [2005]; 6 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG1-01031; No Copyright; Avail: CASI; [A02](#), Hardcopy

A planar laser-induced fluorescence (PLIF) technique is discussed and applied to measurement of time-averaged values of velocity and temperature in an I(sub 2)-seeded N(sub 2) hypersonic free jet facility. Using this technique, a low temperature, non-reacting, hypersonic flow over a simplified model of a reaction control system (RCS) was investigated. Data are presented of rarefied Mach 12 flow over a sharp leading edge flat plate at zero incidence, both with and without an interacting jet issuing from a nozzle built into the plate. The velocity profile in the boundary layer on the plate was resolved. The slip velocity along the plate, extrapolated from the velocity profile data, varied from nearly 100% down to 10% of the freestream value. These measurements are compared with results of a DSMC solution. The velocity variation along the centerline of a jet issuing from the plate was measured and found to match closely with the correlation of Ashkenas and Sherman. The velocity variation in the oblique shock terminating the jet was resolved sufficiently to measure the shock wave thickness.

Author

Laser Induced Fluorescence; Time Temperature Parameter; Time Measurement; Velocity Distribution; Hypersonic Flow; Low Temperature; Reacting Flow; Flat Plates; Sharp Leading Edges

20050199659 NASA Glenn Research Center, Cleveland, OH, USA

Effect of Scattering on the Heat Transfer Behavior of a Typical Semitransparent TBC Material on a Substrate

Spuckler, Charles M.; [2005]; 8 pp.; In English; 29th International Conference on Advanced Ceramics and Composites, 23-28 Jan. 2005, Cocoa Beach, FL, USA

Contract(s)/Grant(s): WBS 22-714-20-09

Report No.(s): AIAA Paper 2005-2846; No Copyright; Avail: CASI; [A02](#), Hardcopy

A parametric study was performed to examine the effects of isotropic scattering on the heat transfer in typical

semitransparent thermal barrier coating on an opaque substrate. Some ceramic materials are semitransparent in the wavelength range where thermal radiation is important. Therefore, absorption, emission, and scattering of thermal radiation by the semitransparent layer and the emissivity of the substrate will affect the heat transfer and temperature in the layer. Scattering which depends on the structure of the semitransparent material can be used to increase the reflectivity of the layer and therefore decrease the heat transfer through the layer. A one dimensional model of a 1 mm thick semitransparent layer on a substrate was used in this study. The front of the semitransparent layer is heated by convection and radiation and the back of the substrate is cooled by radiation and convection. The coating is assumed to be semitransparent up to a cutoff wavelength and opaque at higher wavelengths. The absorption and scattering coefficient are constant over the wavelength range where the material is semitransparent. The absorption coefficient, scattering coefficients, width of the semitransparent band, and the bond coat emissivity are varied. Temperature profiles and heat flux through layers as a function of absorption and scattering coefficients are presented.

Author

Heat Transfer; Scattering; Radiation Absorption; Emissivity; Ceramics; Convection; Thermal Control Coatings

20050199707 NASA Langley Research Center, Hampton, VA, USA

Particle Image Velocimetry Measurements to Evaluate the Effectiveness of Deck-Edge Columnar Vortex Generators on Aircraft Carriers

Landman, Drew; Lamar, John E.; Swift, Russell; [2005]; 16 pp.; In English; RTO/AVT-124 Specialist Meeting on Recent Developments in Non-Intrusive Measurement Technology for Military Application on Model-and Full-Scale Vehicles, 25-29 Apr. 2005, Budapest, Hungary

Contract(s)/Grant(s): 23-090-50-70

Report No.(s): RTO-MP-AVT-124; Paper 7; Copyright; Avail: CASI; [A03](#), Hardcopy

Candidate passive flow control devices were chosen from a NASA flow visualization study to investigate their effectiveness at improving flow quality over a flat-top carrier model. Flow over the deck was analyzed using a particle image velocimeter and a 1/120th scaled carrier model in a low-speed wind tunnel. Baseline (no devices) flow quality was compared to flow quality from combinations of bow and deck-edge devices at both zero and 20 degrees yaw. Devices included plain flaps and spiral cross-section columnar vortex generators attached in various combinations to the front and sides of the deck. Centerline and cross plane measurements were made with velocity and average turbulence measurements reported. Results show that the bow/deck-edge flap and bow/deck-edge columnar vortex generator pairs reduce flight deck turbulence both at zero yaw and at 20 degrees yaw by a factor of approximately 20. Of the devices tested, the most effective bow-only device appears to be the plain flap.

Author

Particle Image Velocimetry; Vortex Generators; Computational Fluid Dynamics; Aircraft Carriers; Low Speed Wind Tunnels; Aircraft Compartments

20050200846 Naval Surface Warfare Center, Bethesda, MD USA

Experiment to Examine the Effect of Scale on a Breaking Bow Wave

Karion, Anna; Fu, Thomas C.; Waniewski-Sur, Tricia; Rice, James R.; Walker, Don C.; Furey, Deborah A.; Dec. 2004; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435388; NSWCCD-50-TR-2004/060; No Copyright; Avail: Defense Technical Information Center (DTIC)

A prismatic wedge was towed in fresh water in the David Taylor Model Basin at the Naval Surface Warfare Center, Carderock Division (NSWCCD), generating a large bow wave. Towing speeds ranged from 0.7 to 4.6 m/s, and drafts ranged from 0.6 to 1.5 m. These conditions correspond to Froude numbers from 0.2 to 1.4, Reynolds numbers from 4.1×10^5 to 7.0×10^6 (both based on draft, D) and Weber numbers from 11 to 2800 (based on bow radius, R). In addition to the variations in draft and speed, two different bow geometries were investigated: one with a 20 degree bow entrance angle, 20 degree flare, and sharp leading edge, and one with a 40 degree bow entrance angle, no flare, and rounded leading edge. Measurements of free-surface elevations near the bow were made using a laser imaging technique. High-speed video of the spray generated by the bow wave was also analyzed to yield droplet size and velocity distributions. These measurements provide a useful data set to researchers wishing to validate advanced numerical techniques. Presently, the results are used to investigate scaling issues associated with breaking bow waves.

DTIC

Bow Waves; Hydromechanics; Models; Ships; Water Waves

20050200852 Stanford Univ., Stanford, CA USA

Transonic Cascade Measurements to Support Analytical Modeling

Durbin, Paul A.; Eaton, John K.; Laskowski, Greg; Vicharelli, Amanda; May 2005; 41 pp.; In English

Contract(s)/Grant(s): F49260-02-1-0284

Report No.(s): AD-A435404; AFRL-SR-AR-TR-05-0263; No Copyright; Avail: CASI; [A03](#), Hardcopy

Turbulence measurements were made in a transonic turbine cascade using PIV in a unique two-passag model consisting of a single full blade and two shaped outer walls. The outer wall shapes were prescribed using an inverse design procedure that gave the correct infinite-cascade pressure and mean velocity distribution around the blade. The outer surfaces of the curved walls were shaped to steer a laser sheet to provide uniform illumination for the PIV. The PIV measurements were performed over a large number of small domains providing excellent spatial resolution over most of the flow field. Measurements in the free stream above the blade boundary layers showed that the absolute magnitude of the turbulent stresses changed little through the strong acceleration and curvature. This means that the relative turbulence intensity falls rapidly as the flow accelerates through the cascade. Detailed comparison to various turbulence models is underway.

DTIC

Mathematical Models; Transonic Flow

20050200873 Purdue Univ., West Lafayette, IN USA

Blade Row Interaction Unsteady Aerodynamics and Variability for Aeromechanics and HCF

Fleeter, Sanford; Jan. 2004; 21 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0040

Report No.(s): AD-A435470; AFRL-SR-AR-TR-05-0186; No Copyright; Avail: CASI; [A03](#), Hardcopy

This research is directed at the development of the technology needed to accurately predict significant blade row forced response in a multistage environment. Specific objectives include addressing design and off-design blade row interaction unsteady aerodynamics including unsteady aerodynamic variability. The technical approach requires that blade row interaction unsteady aerodynamic data be acquired and analyzed for realistic geometries and flow conditions. Thus, experiments are performed in the Purdue Transonic Research Compressor Facility. It features a 1-1/2 stage axial-flow geometry representative of that used in the front stages of advanced high-pressure compressors including advanced controlled diffusion airfoil (CDA) designed in cooperation with Pratt & Whitney. Note that this compressor design was directed at transonic blade row interaction unsteady aerodynamics and HCF studies.

DTIC

Aerodynamic Forces; Compressor Blades; Compressors; Fluid Mechanics; High Pressure; Turbocompressors; Turbomachinery; Unsteady Aerodynamics; Unsteady Flow; Variability

20050200901 Florida Univ., Gainesville, FL USA

Design Tools for Zero-Net Mass-Flux Separation Control Devices

Gallas, Quentin; Holman, Ryan; Cattafesta, Lou; Dec. 2004; 192 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0135

Report No.(s): AD-A435534; AFRL-SR-AR-TR-05-0266; No Copyright; Avail: CASI; [A09](#), Hardcopy

This report discusses the fundamental dynamics of zero-net mass flux (ZNMF) actuators commonly used in active flow-control applications. The present work addresses unresolved technical issues by providing a clear physical understanding of how these devices behave in a quiescent medium and interact with an external boundary layer by developing and validating reduced-order models. The results are expected to ultimately aid in the analysis and development of design tools for ZNMF actuators in flow-control applications.

DTIC

Actuators; Boundary Layer Separation; Control Equipment; Flux Density; Mass Flow; Separated Flow; Software Development Tools

20050200978 Naval Postgraduate School, Monterey, CA USA

Baroclinicity, Forcing Mechanism and Prediction of Chemical Propagation of San Diego Bay and Their Effects on Naval Applications

Kyriakidis, Kleanthis; Jun. 2005; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435669; No Copyright; Avail: Defense Technical Information Center (DTIC)

Both instantaneous current and chemical propagation predictions are of utmost importance for all littoral naval operations,

including diving, amphibious and mine warfare ones. Undoubtedly, the operating limits and environmental thresholds are crucial and highly reliant on the accuracy and precision of the predictions. San Diego Bay is important because it hosts a large part of the U.S. fleet and has special ecological significance. A hydrodynamic model, 'Water Quality Management and Analysis Package' (WQMAP), is used to predict the instantaneous currents with various forcing functions (tides, winds, and lateral boundary fluxes) and a hydrochemical model, 'Chemical Management and Analysis Package', (CHEMMAP) to predict the water contamination and to simulate chemical attacks/accidents in San Diego Bay, which raise considerations regarding public health, economy, ecology or even national security. The study shows the barotropic nature of San Diego Bay, the slight significance of wind and the vulnerability of a semi-enclosed tidal basin in a possible chemical attack or accident. Simultaneously, it evaluates and uses two models used by NAVOCEANO.

DTIC

Baroclinity; Contaminants; Predictions

20050200980 Naval Postgraduate School, Monterey, CA USA

Breaking Wave Turbulence in the Surf Zone

Sweeny, Margaret E.; Jun. 2005; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435679; No Copyright; Avail: Defense Technical Information Center (DTIC)

An increasingly exercised and precarious region of the maritime battlefield is the surf zone. Wave properties and turbulence dissipation from breaking waves in the surf zone were calculated from data collected during the 2001 RIPEX/ steep Beach Experiment. Wave characteristics, such as current velocities, period, significant wave and sea surface height, and tide were examined. The tide was shown to have the major influence on the breadth and the location of the surf zone from the shoreline. Video imaging time series were geometrically transformed into plan views of pixel brightness related to wave breaking intensity. Surf zone boundaries were generated using both a computer algorithm and manual manipulation. Two methods were examined for calculating breaking wave dissipation rates for particularly robust days (110.5 -114.5). Velocity data were acquired using two electromagnetic current meters over the vertical mounted on a tower at mid-surf zone. The first method identified individual bores, which were ensemble averaged by phase over 30 minute records to obtain wave number spectra invoking Taylor's frozen turbulence hypothesis. Maximum dissipation rates underneath the bore cycle were shown to lag behind the sea surface elevation. The second method used 30 minute ensemble averaged spectra to obtain dissipation after Trowbridge and Elgar (2001). Dissipation rates calculated underneath each bore segment were orders of magnitude smaller when compared to the ensemble averaged technique.

DTIC

Ocean Surface; Turbulence

20050201015 Naval Postgraduate School, Monterey, CA USA

Ocean Circulation and Exchanges Through the Bering Sea: 1979-2001 Model Results

Jun. 2005; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435745; No Copyright; Avail: Defense Technical Information Center (DTIC)

A model has been developed and run with sufficiently high resolution (~ 9 km and 45 levels) and a large enough spatial domain to allow for realistic representation of flow through the narrow and shallow straits in the Bering Sea region. This is potentially important for quantification of long-term mean and time-dependent ocean circulation, and water mass and property exchanges between the Pacific and Arctic oceans. The mean modeled circulation in the Bering Sea is found to be in good agreement with the limited observational data. The Bering Sea Basin, Bering Slope Current, and straits on the northern shelf are identified as highly energetic regions based on eddy kinetic energy fields. Some high biological productivity regions of the northern Bering Sea identified in observational studies are coincident with regions of persistently high energy (up to 2600 $\text{cm}^2 \text{ s}^{-2}$ at mid-depth) throughout the annual cycle. Over a twenty three year interval (1979-2001), mean transport through Bering Strait is estimated to be 0.65 Sv. Comparison of model results with published observations indicates that ocean circulation is not only variable at seasonal to interdecadal scales, but it is also responsive to short-term atmospheric forcing. Comparison with observations of near bottom salinity indicates that the model is reasonably representing the major water mass properties. The long-term model results for the Bering Sea provide important insights into the ocean circulation and fluxes and they are a useful frame of reference for limited observations that are short-term and/or cover only a small geographic region.

DTIC

Bering Sea; Ocean Currents; Ocean Models

20050201793 NASA Glenn Research Center, Cleveland, OH, USA

The Influence of Dynamic Contact Angle on Wetting Dynamics

Rame, Enrique; Garoff, Steven; January 2005; 1 pp.; In English; Lab Fusion 2004, 13-16 June 2004, Boston, MA, USA

Contract(s)/Grant(s): NCC-975; Copyright; Avail: Other Sources; Abstract Only

When surface tension forces dominate, and regardless of whether the situation is static or dynamic, the contact angle (the angle the interface between two immiscible fluids makes when it contacts a solid) is the key parameter that determines the shape of a fluid-fluid interface. The static contact angle is easy to measure and implement in models predicting static capillary surface shapes and such associated quantities as pressure drops. By contrast, when the interface moves relative to the solid (as in dynamic wetting processes) the dynamic contact angle is not identified unambiguously because it depends on the geometry of the system. Consequently, its determination becomes problematic and measurements in one geometry cannot be applied in another for prediction purposes. However, knowing how to measure and use the dynamic contact angle is crucial to determine such dynamics as a microsystem throughput reliably. In this talk we will present experimental and analytical efforts aimed at resolving modeling issues present in dynamic wetting. We will review experiments that show the inadequacy of the usual hydrodynamic model when a fluid-fluid meniscus moves over a solid surface such as the wall of a small tube or duct. We will then present analytical results that show how to parametrize these problems in a predictive manner. We will illustrate these ideas by showing how to implement the method in numerical fluid mechanical calculations.

Author

Interfacial Tension; Surface Properties; Wetting; Solid Surfaces; Predictions

20050201952 Bureau of Reclamation, Denver, CO, USA

Evaluation of Flow Rate of 20-inch-Diameter Permeability Test System

Metcalf, T. E.; May 1986; 22 pp.; In English

Report No.(s): PB2005-107616; GR-86-8; No Copyright; Avail: CASI; [A03](#), Hardcopy

Laboratory permeability tests on soils containing gravel that were performed using designation E- 14 in the Earth Manual (Permeability and Settlement of Soil Containing Gravel) showed what appeared to be inconsistent results when coefficients of hydraulic conductivity were determined at flow rates approaching the hydraulic conductivity limit of the test system. Although this behavior was noted before, the specific reasons for the inconsistency were not investigated or documented. The primary problem with the test data appears in the form of decreasing calculated coefficients of hydraulic conductivity as the hydraulic gradient is increased. Although this appears unreasonable, it occurs because the test system operates at a flow rate where a linear flow rate versus hydraulic head relationship does not exist because of the test equipment configuration. To illustrate this behavior, a brief evaluation of the flow rate of the test equipment was performed, and the results were compared with results from an actual permeability test. This information was useful in identifying inadequacies in the existing test apparatus, and it provides the basis for guidelines used to evaluate the results of permeability tests.

NTIS

Flow Velocity; Permeability; Soils

20050201953 Bureau of Reclamation, Denver, CO, USA

Hydraulic Flume Laboratory Erosion-Test Equipment

Acciardi, R. G.; Nov. 1984; 92 pp.; In English

Report No.(s): PB2005-107611; GR-84-16; No Copyright; Avail: CASI; [A05](#), Hardcopy

The overall purpose of this project was to plan for, acquire, and place in operation laboratory test equipment to determine the potential resistance of soils to surface erosion from flowing water. This equipment would be used for testing nondispersive soils in auxiliary and emergency spillways, earth-lined and unlined channels, canals, wasteways, compacted embankments, and other structures. This project is listed as No. DB-13 under the USBR (Bureau of Reclamation) PRESS (Program Related Engineering and Scientific Studies) and is entitled, Identification of Potentially Erosive Soils. USBR Report No. GR-82-3 (1) discusses phase I of the project, which was completed in FY 1981. The approach for phase I involved a review of the literature on the subject and recommendations for obtaining laboratory equipment suitable for USBR erosion testing. Phase II, performed during FY 1982 and FY 1983, comprised acquisition of the equipment, calibration, and placement in operation. Phase III includes the testing of different soils from field sites to establish criteria for assessing the potential erosion resistance for anticipated field conditions. It should begin in FY 1984. This report summarizes the results of phase II investigations: (1) equipment acquisition, (2) hydraulic calibration, (3) preliminary operation, and (4) modifications made to improve the operation of the laboratory erosion flume.

NTIS

Erosion; Hydraulic Analogies; Hydraulic Equipment; Laboratory Equipment

20050201954 Bureau of Reclamation, Denver, CO USA

Solutions to Problems in Waterhammer Analysis

Donsky, B.; Logan, T. H.; Gebhard, C. W.; January 1962; 140 pp.; In English

Report No.(s): PB2005-107614; No Copyright; Avail: CASI; [A07](#), Hardcopy

This publication is a compilation of solutions and discussions of the problems in the book 'Waterhammer Analysis' by John Parmakian. It was compiled to be used in conjunction with the book, for the Management Technical Training Course in Waterhammer Analysis. The solutions presented primarily demonstrate the methods presented in each chapter of Mr. Parmakian's book, and the answers are of slide rule accuracy. Those problems solved by other methods may be somewhat different.

NTIS

Pipelines; Water Hammer

20050201996 Lawrence Livermore National Lab., Livermore, CA USA

Effect of Insolation Boundary Conditions on Type B Package Internal Temperatures

Hovingh, J.; Shah, V. L.; May 30, 2002; 14 pp.; In English

Report No.(s): DE2005-15013567; UCRL-JC-148654; No Copyright; Avail: Department of Energy Information Bridge

The prescription of the initial conditions and the final conditions for a thermal accident for Type B packages are different for differing regulations. This paper presents an analytical method for estimating the effect of the boundary conditions on post-fire peak internal package temperatures. Results are given for several boundary conditions for a Type B drum-type package.

NTIS

Boundary Conditions; Insolation; Packaging; Radioactive Materials

20050203675 Air Force Research Lab., USA, NASA Glenn Research Center, Cleveland, OH, USA

Variable Gravity Effects on the Cooling Performance of a Single Phase Confined Spray

Michalak, Travis; Yerkes, Kirk; Baysinger, Karri; McQuillen, John; [2005]; 1 pp.; In English; ASME Heat Transfer Conference, 17-22 Jul. 2005, San Francisco, CA, USA

Contract(s)/Grant(s): SAA3-307; 22R-101-53-03-61-01; No Copyright; Avail: Other Sources; Abstract Only

The objective of this paper is to discuss the testing of a spray cooling experiment designed to be flown on NASA's KC-135 Reduced Gravity Testing Platform. Spray cooling is an example of a thermal management technique that may be utilized in high flux heat acquisition and high thermal energy transport concepts. Many researchers have investigated the utility of spray cooling for the thermal management of devices generating high heat fluxes. However, there has been little research addressing the physics and ultimate performance of spray cooling in a variable gravity environment. An experimental package, consisting of a spray chamber coupled to a fluid delivery loop system, was fabricated for variable gravity flight tests. The spray chamber contains two opposing nozzles spraying on target Indium Tin Oxide (ITO) heaters. These heaters are mounted on glass pedestals, which are part of a sump system to remove unconstrained liquid from the test chamber. Liquid is collected in the sumps and returned to the fluid delivery loop. Thermocouples mounted in and around the pedestals are used to determine both the heat loss through the underside of the ITO heater and the heat extracted by the spray. A series of flight tests were carried out aboard the KC-135, utilizing the ability of the aircraft to produce various gravity conditions. During the flight tests, for a fixed flow rate, heat input was varied at 20, 30, 50, and 80W with variable gravities of 0.01, 0.16, 0.36, and 1.8g. Flight test data was compared to terrestrial baseline data in addition to analytical and numerical solutions to evaluate the heat transfer in the heater and support structure. There were significant differences observed in the spray cooling performance as a result of variable gravity conditions and heat inputs. In general, the Nusselt number at the heater surface was found to increase with decreasing gravity conditions for heat loads greater than 30W.

Author

Cooling; Microgravity; Gravitational Effects; Fabrication

20050203705 Toledo Univ., OH, USA, NASA Glenn Research Center, Cleveland, OH, USA

Aeroelastic Calculations of Quiet High-Speed Fan Performed

Bakhle, Milind A.; Srivastava, Rakesh; Mehmed, Oral; Min, James B.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

An advanced high-speed fan was recently designed under a cooperative effort between the NASA Glenn Research Center and Honeywell Engines & Systems. The principal design goals were to improve performance and to reduce fan noise at

takeoff. Scale models of the Quiet High-Speed Fan were tested for operability, performance, and acoustics. During testing, the fan showed significantly improved noise characteristics, but a self-excited aeroelastic vibration known as flutter was encountered in the operating range. Flutter calculations were carried out for the Quiet High-Speed Fan using a three-dimensional, unsteady aerodynamic, Reynolds-averaged Navier-Stokes turbomachinery code named 'TURBO.' The TURBO code can accurately model the viscous flow effects that can play an important role in various aeroelastic problems such as flutter with flow separation, flutter at high loading conditions near the stall line (stall flutter), and flutter in the presence of shock and boundary-layer interaction. Initially, calculations were performed with no blade vibrations. These calculations were at a constant rotational speed and a varying mass flow rate. The mass flow rate was varied by changing the backpressure at the exit boundary of the computational domain. These initial steady calculations were followed by aeroelastic calculations in which the blades were prescribed to vibrate harmonically in a natural mode, at a natural frequency, and with a fixed interblade phase angle between adjacent blades. The AE-prep preprocessor was used to interpolate the in-vacuum mode shapes from the structural dynamics mesh onto the computational fluid dynamics mesh and to smoothly propagate the grid deformations from the blade surface to the interior points of the grid. The aeroelastic calculations provided the unsteady aerodynamic forces on the blade surface due to blade vibrations. These forces were vector multiplied with the structural dynamic mode shape to calculate the work done on the blade during one vibration period, then this result was converted to an aerodynamic damping. Flutter occurs when the aerodynamic damping becomes negative, if structural damping is ignored. The results of these aeroelastic calculations are summarized in this plot of aerodynamic damping versus mass flow rate at a constant rotational speed. As the backpressure is increased, the mass flow rate through the fan decreases and the fan operating point moves towards the stall line. The aeroelastic calculations showed that the aerodynamic damping decreases as the stall line is approached, as observed during testing. In addition, the aeroelastic calculations with the TURBO code correctly predicted the aeroelastic parameters: the most unstable vibration mode and interblade phase angle, as observed during testing. The Quiet High-Speed Fan demonstrated significant noise reductions during testing, but flutter imposed limits on its operating range. The accurate calculation of the aeroelastic characteristics using the TURBO code is a significant step toward eliminating flutter from the operating range and toward realizing the benefits of reduced fan noise. The aeroelastic calculations described here were performed under a grant by University of Toledo researchers in collaboration with Glenn's researchers.

Author

Aerodynamic Noise; Aeroelasticity; Computational Fluid Dynamics; Fan Blades; High Speed

20050203717 Canadian Space Agency, Ottawa, Ontario, Canada

Refurbishment of a Large Thermal-Vacuum Space Simulation Chamber

LeBlanc, Raymond; Choueiry, Elie; 23rd Space Simulation Conference Proceedings; [2005]; 45 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper addresses the refurbishment of the TV5 Thermal-Vacuum Chamber (TV5 formerly known as the 22'x35' TVAC Chamber), Canada's largest Space Simulation Chamber, located at the David Florida Laboratory of the Canadian Space Agency in Ottawa, Ontario, Canada. Expansions to the David Florida Laboratory in 1995 necessitated the removal of several key systems that were part of the TV5's infrastructure - notably the systems required for thermal recovery of the chamber as well as the liquid nitrogen dump tank. This paper will present the modification and refurbishments to the TV5's infrastructure systems and other associated systems that were in need of upgrades. The material will be presented in the order that the systems were phased-in, namely: Phase I - Vacuum Integrity: Whereby the vacuum systems were repaired, upgraded and brought on-line, and the chamber's vacuum integrity was certified. These repairs and certifications will be presented. Phase II - Liquid Nitrogen (LN2) Cooling Capability: Whereby the liquid nitrogen delivery systems were repaired, and the distribution systems modified with accommodations for recovery system components, as well as a new liquid nitrogen flood mitigation system. The resulting layout will be put forward. Phase III - Thermal Recovery System: The entire recovery strategy for the chamber was reviewed and scrutinized. The resulting findings had a profound affect on the systems required for the safe and efficient recovery of the chamber. The findings and the resulting systems will be presented. Phase IV - Liquid Nitrogen Recirculation System (LNRS): Formerly known as the Skid System, the LNRS had been repaired piece-meal over the years, this resulted in a rather problematic system. The upgrade and rework of the system will be presented. In addition to describing the activities that were performed on the TV5, the issues still outstanding with the facility will be discussed.

Author

Thermal Simulation; Vacuum Systems; Vacuum Chambers; Liquid Nitrogen; On-Line Systems

20050203846 NASA Glenn Research Center, Cleveland, OH, USA

Phased-Array Measurements of Single Flow Hot Jets

Bridges, James; Lee, Sang Soo; July 2005; 24 pp.; In English; 11th Aeroacoustics Conference, 23-25 May 2005, Monterey, CA, USA

Contract(s)/Grant(s): WBS 22-731-30-62

Report No.(s): NASA/TM-2005-213826; E-15185; AIAA Paper 2005-2842; No Copyright; Avail: CASI; [A03](#), Hardcopy

A 16 microphone phased-array system has been successfully applied to measure jet noise source distributions. In this study, a round convergent nozzle was tested at various hot and cold flow conditions: acoustic Mach numbers are between 0.35 and 1.6 and static temperature ratios are varied from cold to 2.7. The classical beamforming method was applied on narrowband frequencies. From the measured source distributions locations of peak strength were tracked and found to be very consistent between adjacent narrowband frequencies. In low speed heated and unheated jets, the peak source locations vary smoothly from the nozzle exit to downstream as the frequency is decreased. When the static temperature ratio was kept constant, the peak source position moved downstream with increasing acoustic Mach number for the Strouhal numbers smaller than about 1.5. It was also noted that the peak source locations of low frequencies occur farther downstream than the end of potential core.

Author

Jet Flow; Phased Arrays; Aeroacoustics; Jet Aircraft Noise

20050203855

Liquid flow and distribution in unsaturated porous media

[2004]; 1 pp.; In English; Gordon Research Conference on Flow and Transport, 11-15 Jul. 2004, Oxford, UK, UK; No Copyright; Avail: Other Sources; Abstract Only

Flow and transport in permeable or porous media and microchannels occurs in a variety of situations in micro- and reduced-gravity environments, many of them associated with environmental control and life support systems. While the role of gravity is limited, due to the typically small size scales associated permeable media, gravity, at the very least, affects the overall disposition of fluid in a macroscopic system. This presentation will discuss examples where the absence of gravity affects flow and phase distribution in selected examples of unsaturated flow and transport of heat and mass in porous media and microchannels that are pertinent to spacecraft systems.

Author

Liquid Flow; Porosity; Media; Unsaturation (Chemistry); Flow Distribution

20050203862 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Capillary-Driven Flow in Liquid Filaments Connecting Orthogonal Channels

Allen, Jeffrey S.; [2005]; 1 pp.; In English

Contract(s)/Grant(s): NCC3-975; No Copyright; Avail: Other Sources; Abstract Only

Capillary phenomena plays an important role in the management of product water in PEM fuel cells because of the length scales associated with the porous layers and the gas flow channels. The distribution of liquid water within the network of gas flow channels can be dramatically altered by capillary flow. We experimentally demonstrate the rapid movement of significant volumes of liquid via capillarity through thin liquid films which connect orthogonal channels. The microfluidic experiments discussed provide a good benchmark against which the proper modeling of capillarity by computational models may be tested. The effect of surface wettability, as expressed through the contact angle, on capillary flow will also be discussed.

Author

Fluid Management; Capillary Flow; Fluidics; Water; Gas Flow

20050203865 NASA Glenn Research Center, Cleveland, OH, USA

Carbon-Carbon Recuperators in Closed-Brayton-Cycle Nuclear Space Power Systems: A Feasibility Assessment

Barrett, Michael J.; Johnson, Paul K.; [2004]; 1 pp.; In English; 2nd International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): 973-80-10; No Copyright; Avail: Other Sources; Abstract Only

The feasibility of using carbon-carbon recuperators in closed-Brayton-cycle (CBC) nuclear space power conversion systems (PCS) was assessed. Recuperator performance expectations were forecast based on projected thermodynamic cycle state values for a planetary mission. Resulting thermal performance, mass and volume for a plate-fin carbon-carbon recuperator were estimated and quantitatively compared with values for a conventional offset-strip-fin metallic design.

Material compatibility issues regarding carbon-carbon surfaces exposed to the working fluid in the CBC PCS were also discussed.

Author

Brayton Cycle; Feasibility Analysis; Satellite Solar Energy Conversion; Temperature Effects; Thermodynamic Cycles; Closed Cycles; Solar Cells

20050203874 NASA Glenn Research Center, Cleveland, OH, USA

Tip-Clearance Vortex Characterized With Three-Dimensional Digital Particle Image Velocimetry

John, W. Trevor; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

An optical measurement technique known as Three-Dimensional Digital Particle Image Velocimetry (3-D DPIV) was used to characterize the tip clearance flow in NASA Glenn Research Center's low-speed axial compressor. 3-D DPIV is a technique in which a stereoscopic imaging system consisting of two cross-correlation cameras is used to record particles entrained in a flow as a laser light sheet is pulsed at two instances in time. Although 3-D DPIV has been used elsewhere, this is the first time it has been used to measure compressor tip clearance flows. In-house modifications of the DPIV system include the use of effective seeding technology and a novel system to perform a priori calibrations at all five measurement planes, greatly reducing facility run time. Computational fluid dynamics predictions, which are used to guide design changes toward improving the efficiency and operating range of turbomachinery, can be verified and improved by comparison with 3-D DPIV measurements of the actual tip clearance flow. This measurement campaign dealt with the characterization of the tip clearance vortex in the first stage of a four-stage axial compressor. The tip clearance vortex is formed in compressors operating with a clearance gap between the moving rotor blade tips and the stationary casing when a leakage flow, forced from the pressure side of the blade over the blade tip, forms a vortical structure on the suction side of the blade. 3-D DPIV is ideally suited to measure the clearance vortex for two reasons: (1) this technique captures the entire blade passage flow at one instant in time, so that wandering of the vortex during the measurement does not smear out velocity gradients in the flow field, and (2) the spanwise component of velocity changes sign across the vortex core, providing a more accurate measurement of the vortex location than was available with previous two-dimensional measurement approaches. These two attributes of the data will enable computational fluid dynamics researchers to validate their predictions to a level of accuracy not previously attainable. In an effort to understand the effects of this flow phenomenon on the operation of the low speed axial compressor, data were acquired at two mass flow coefficients: 0.395 (design operating point) and 0.35 (operating point just above stall). In order to identify the spatial extent, location, and magnitude of the tip clearance vortex for each mass flow condition, data were acquired at five equally spaced spanwise locations, from 90- to 100-percent span. The data presented shows a cross section of the tip clearance vortex at 94-percent span and a mass flow coefficient of 0.395, where the color contours represent the radial velocity component. The blue (flow towards the hub) and red (flow towards the casing) regions illustrate the extent of the tip clearance vortex. The interface between the blue and red regions delineates the location of the vortex core.

Author (revised)

Computational Fluid Dynamics; Digital Techniques; Particle Image Velocimetry; Vortices; Blade Tips; Three Dimensional Models

20050203951 NASA Marshall Space Flight Center, Huntsville, AL, USA

Advanced Computational Modeling of Vapor Deposition in a High-Pressure Reactor

Cardelino, Beatriz H.; Moore, Craig E.; McCall, Sonya D.; Cardelino, Carlos A.; Dietz, Nikolaus; Bachmann, Klaus; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Original contains color illustrations

Contract(s)/Grant(s): NAG8-1686; NSF CHE-02-13467; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In search of novel approaches to produce new materials for electro-optic technologies, advances have been achieved in the development of computer models for vapor deposition reactors in space. Numerical simulations are invaluable tools for costly and difficult processes, such as those experiments designed for high pressures and microgravity conditions. Indium nitride is a candidate compound for high-speed laser and photo diodes for optical communication system, as well as for semiconductor lasers operating into the blue and ultraviolet regions. But InN and other nitride compounds exhibit large thermal decomposition at its optimum growth temperature. In addition, epitaxy at lower temperatures and subatmospheric pressures incorporates indium droplets into the InN films. However, surface stabilization data indicate that InN could be grown at 900 K in high nitrogen pressures, and microgravity could provide laminar flow conditions. Numerical models for chemical

vapor deposition have been developed, coupling complex chemical kinetics with fluid dynamic properties.

Author

Reaction Kinetics; Vapor Deposition; Mathematical Models; High Pressure; Reactors; Thermal Decomposition

20050203984 NASA Glenn Research Center, Cleveland, OH, USA

Unitized Regenerative Fuel Cell System Gas Storage/Radiator Development

Jakupca, Ian; Burke, Kenneth A.; December 12, 2003; 1 pp.; In English; SAE Power Systems Conference, 2-4 Nov. 2004, Reno, NV, USA

Contract(s)/Grant(s): WBS 319-20-J1; No Copyright; Avail: Other Sources; Abstract Only

The ancillary components for Unitized Regenerative Fuel Cell (URFC) Energy Storage System are being developed at the NASA Glenn Research Center. This URFC system is unique in that it uses the surface area of the hydrogen and oxygen storage tanks as radiating heat surfaces for overall thermal control of the system. The waste heat generated by the URFC stack during charging and discharging is transferred from the cell stack to the surface of each tank by loop heat pipes. The heat pipes are coiled around each tank and covered with a thin layer of thermally conductive layer of carbon composite. The thin layer of carbon composite acts as a fin structure that spreads the heat away from the heat pipe and across the entire tank surface. Two different sized commercial grade composite tanks were constructed with integral heat pipes and tested in a thermal vacuum chamber to examine the feasibility of using the storage tanks as system radiators. The storage radiators were subjected to different steady-state heat loads and varying heat load profiles. The surface emissivity and specific heat capacity of each tank were calculated. The results were incorporated into a model that simulates the performance of similar radiators using lightweight, space rated carbon composite tanks.

Author

Energy Storage; Heat Pipes; Regenerative Fuel Cells; Heat Radiators; Storage Tanks

20050203996 NASA Marshall Space Flight Center, Huntsville, AL, USA

CFD Code Validation of Wall Heat Fluxes for a G02/GH2 Single Element Combustor

Lin, Jeff; West, Jeff S.; Williams, Robert W.; Tucker, P. Kevin; [2005]; 15 pp.; In English; 41st AIAA/ASME/SAE Joint Propulsion Conference, 10-13 Jul. 2005, Tucson, AZ, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2005-4524; No Copyright; Avail: CASI; [A03](#), Hardcopy

This paper puts forth the case for the need for improved injector design tools to meet NASA's Vision for Space Exploration goals. Requirements for this improved tool are outlined and discussed. The potential for Computational Fluid Dynamics (CFD) to meet these requirements is noted along with its current shortcomings, especially relative to demonstrated solution accuracy. The concept of verification and validation is introduced as the primary process for building and quantifying the confidence necessary for CFD to be useful as an injector design tool. The verification and validation process is considered in the context of the Marshall Space Flight Center (MSFC) Combustion Devices CFD Simulation Capability Roadmap via the Simulation Readiness Level (SRL) concept. The portion of the validation process which demonstrates the ability of a CFD code to simulate heat fluxes to a rocket engine combustor wall is the focus of the current effort. The FDNS and Loci-CHEM codes are used to simulate a shear coaxial single element G02/GH2 injector experiment. The experiment was conducted at a chamber pressure of 750 psia using hot propellants from preburners. A measured wall temperature profile is used as a boundary condition to facilitate the calculations. Converged solutions, obtained from both codes by using wall functions with the K-E turbulence model and integrating to the wall using Mentor's baseline turbulence model, are compared to the experimental data. The initial solutions from both codes revealed significant issues with the wall function implementation associated with the recirculation zone between the shear coaxial jet and the chamber wall. The FDNS solution with a corrected implementation shows marked improvement in overall character and level of comparison to the data. With the FDNS code, integrating to the wall with Mentor's baseline turbulence model actually produce a degraded solution when compared to the wall function solution with the K-E model. The Loci-CHEM solution, produced by integrating to the wall with Mentor's baseline turbulence model, matches both the heat flux rise rate in the near injector region and the peak heat flux level very well. However, it moderately over predicts the heat fluxes downstream of the reattachment point. The Loci-CHEM solution achieved by integrating to the wall with Mentor's baseline turbulence model was clearly superior to the other solutions produced in this effort.

Author

Computational Fluid Dynamics; Computer Programs; Wall Temperature; Injectors; Design Analysis; Temperature Profiles

INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20050199444 NASA Glenn Research Center, Cleveland, OH, USA

Microscale Particulate Classifiers (MiPAC) Being Developed

Greenberg, Paul S.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Glenn Research Center is developing microscale sensors to characterize atmospheric-borne particulates. The devices are fabricated using MEMS (microelectromechanical systems) technologies. These technologies are derived from those originally developed in support of the semiconductor processing industry. The resulting microsensors can characterize a wide range of particles and are, therefore, suitable to a broad range of applications. This project is supported under a collaborative program called the Glennan Microsystems Initiative. The initiative comprises members of NASA Glenn Research Center, various university affiliates from the State of Ohio, and a number of participating industrial partners. Funding is jointly provided by NASA, the State of Ohio, and industrial members. The work described here is a collaborative arrangement between researchers at Glenn, the University of Minnesota, The National Institute of Standards and Technology (NIST), and the Cleveland State University. Actual device fabrication is conducted at Glenn and at the laboratories of Case Western Reserve University. Case Western is also located in Cleveland, Ohio, and is a participating member of the initiative. The principal investigator for this project is Paul S. Greenberg of Glenn. Two basic types of devices are being developed, and target different ranges of particle sizes. The first class of devices, which is used to measure nanoparticles (i.e., particles in the range of 0.002 to 1 μm), is based on the technique of Electrical Mobility Classification. This technique also affords the valuable ability of measuring the electrical charge state of the particles. Such information is important in the understanding of agglomeration mechanisms and is useful in the development of methods for particle repulsion. The second type of device being developed, which utilizes optical scattering, is suitable for particles larger than 1 μm . This technique also provides information on particle shape and composition. Applications for these sensors include fundamental planetary climatology, monitoring and filtration in spacecraft, human habitation modules and related systems, characterization of particulate emissions from propulsion and power systems, and as early warning sensors for both space-based and terrestrial fire detection. These devices are also suitable for characterizing biological compounds such as allergens, infectious agents, and biotoxic agents.

Author

Agglomeration; Charged Particles; Detection; Early Warning Systems; Micrometeorology

20050199462 NASA Glenn Research Center, Cleveland, OH, USA

Sub-Nyquist Distortions in Sampled One- and Two-Dimensional Signals Studied

Williams, Glenn L.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Hardware testing frequently involves the acquisition of waveform and instrumentation signals, which are often recorded on waveform recorders, oscillographs, and video recorders. Years ago, the waveforms were viewed as analog records, as drawn by a paper strip chart pen or electron beam on a cathode ray tube screen. One of the problems in the past was that the analog electronics may not have been able to accurately display the full amplitude of a signal if the real-time signals exceeded the frequency response bandwidth of the recording device. The advent of digital oscilloscopes, waveform recorders, and video frame-grabbers solved many of the frequency response problems, though not all. A restriction on digital waveform acquisition is well known by people in the instrumentation field. Put simply, the sampling frequency must be at least twice the frequency of any signal to be sampled, or vice versa; the signals must be filtered so that none of the signal frequencies are higher than one-half the sample rate (the Nyquist Limit). Then, per Shannon's Sampling Theorem (1949, ref. 1), any sampled signal can be reconstructed for viewing on a display device. If any signals exceed the Nyquist frequency limit, error signals called aliases occur in the output display.

Derived from text

Digital Systems; Oscilloscopes; Nyquist Frequencies

20050200844 Auburn Univ., AL USA

Chloroform-Treated Filamentous Phage as a Bioreceptor for Piezoelectric Sensors

Olsen, Eric V.; Sykora, Jennifer C.; Sorokulova, Iryna B.; Petrenko, Valery A.; Chen, I-Hsuan; Barbaree, James M.; Vodyanoy, Vitaly J.; Jan. 2005; 52 pp.; In English

Report No.(s): AD-A435379; CI04-1125; No Copyright; Avail: CASI; [A04](#), Hardcopy

Affinity-selected filamentous bacteriophage was induced to spherical forms ('spheroids') by chloroform treatment and deposited to piezoelectric transducers by Langmuir-Blodgett to prepare biosensors for the detection of streptavidin and *S. typhimurium*. ELISA confirmed affinity-selected phage specificity for streptavidin. Spheroid induction was optimized to achieve greatest conversion yields as a function of solvent exposure time and concentration. Results from whole-virion agarose gel electrophoresis indicated 27-fold phage aqueous dilutions mixed with equal volumes of chloroform for 60 s at room temperature was adequate. Phage conversion to spheroids with subsequent binding to *S. typhimurium* was confirmed by transmission electron microscopy. Spheroids for streptavidin and *S. typhimurium* prepared as either pure monolayers of phage coat proteins or proteins reconstituted with phospholipids were evaluated by isotherm, elasticity, and transfer ratio analysis. Results showed that spheroids combined with phospholipids produced a phage coat monolayer possessing higher elasticity and transfer ratios than monolayers of phage coat proteins alone, resulting in spatially superior deposition to substrates and subsequent firm binding of *S. typhimurium* that followed mass theory for piezoelectric transducers. Scanning electron microscopy confirmed binding of streptavidin-coated beads and *S. typhimurium* to prepared biosensors. In summary, spheroid-based sensors could be an effective analytical method for detecting and monitoring quantitative changes of bacterial agents under any conditions that warrant their recognition.

DTIC

Bacteriophages; Bioinstrumentation; Biological Effects; Chloroform; Detection; Piezoelectric Transducers; Piezoelectricity; Spheroids

20050200906 Naval Postgraduate School, Monterey, CA USA

Simulation of Performance of Quantum Well Infrared Photodetectors

Psarakis, Eftychios; Jun. 2005; 157 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435542; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this thesis the performance of a step quantum well infrared photodetector, designed by Kevin Lantz (June 2002) and experimentally studied by Michael Touse (September 2003) and Yeo Hwee Tiong (December 2004), was simulated in Matlab using the transfer matrix method. The results, obtained by the Matlab problem, are compared with the experimental results, in an attempt to make inferences about the optimum way of designing QWIP detectors. Simulation of the above implies numerical solution of the Schroedinger equation, using algorithms and methods, which give accurate results. In our approach, the transfer matrix method (TMM) was used with exponentials and Airy functions to represent the solutions to Schroedinger equation under zero and non-zero bias, respectively. The calculated results were compared with the experimental data and found to provide a good agreement which validated the accuracy of the model employed. In the final section of the thesis we examine and simulate in Matlab the application of the extended Kalman filtering (EKF) to an infrared photodetector as a target tracking mechanism to both maneuvering and non-maneuvering targets. When we used one sensor for tracking, the results were reliable provided that the target did not maneuver. In the case of a maneuvering target the results were significantly improved when we used both sensors for tracking.

DTIC

Infrared Detectors; Infrared Radiation; Photometers; Quantum Wells; Simulation

20050200928 Naval Postgraduate School, Monterey, CA USA

Focusing ISAR Images using Fast Adaptive Time-Frequency and 3D Motion Detection on Simulated and Experimental Radar Data

Brinkman, Wade; Jun. 2005; 143 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435580; No Copyright; Avail: Defense Technical Information Center (DTIC)

Optimization algorithms were developed for use with the Adaptive Joint Time-Frequency (AJFT) algorithm to reduce Inverse Synthetic Aperture Radar (ISAR) image blurring caused by higher-order target motion. A specific optimization was then applied to 3D motion detection. Evolutionary search methods based on the Genetic Algorithm (GA) and the Particle Swarm Optimization (PSO) algorithm were designed to rapidly traverse the solution space in order to find the parameters that would bring the ISAR image into focus in the cross-range. 3D motion detection was achieved by using the AJTF PSO to extract the phases of 3 different point scatterers in the target data and measuring their linearity when compared to an ideal

phase for the imaging interval under investigation. The algorithms were tested against both simulated and real ISAR data sets.
DTIC

Algorithms; Detection; Frequency Measurement; Radar Detection; Synthetic Aperture Radar

20050200953 Monterey Inst. for Research in Astronomy, Marina, CA USA

Irradiance Calibration of Space-Based Infrared Sensors

Walker, Russell G.; Jayaraman, Sumita; Cohen, Martin; Barker, Elizabeth; Jul. 2004; 21 pp.; In English

Contract(s)/Grant(s): F19628-98-C-0047; Proj-MSX8

Report No.(s): AD-A435636; MIRA-2004-AR05; AFRL-VS-HA-TR-2004-1161; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose of this work is to develop a basis for irradiance calibration of space-based infrared sensors. It is an extension of previous work that fully defines the context of the calibration, and concepts of spectral composites and templates. We discuss the work carried out during the past two years directed toward the production and release of Version 2.0 of the Air Force Bright Spectra Atlas (AFBSA V2.O). This report is also the Explanatory Supplement for the AFBSA V2.O.

DTIC

Calibrating; Infrared Detectors; Irradiance

20050200970 Naval Postgraduate School, Monterey, CA USA

Propagation and Performance Analysis for a 915 MHz Wireless IR Image Transfer System

Felekoglu, Oktay; Jun. 2005; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435661; No Copyright; Avail: Defense Technical Information Center (DTIC)

A 915 MHz wireless IR image transfer system, comprised of an IR-160 Thermal Camera and MDS iNet 900 transceivers, was assessed for image transfer capabilities in different environments. Image transfer through natural and artificial obstruction, the capability of transferring images under urban environments, and an exploration of interference issues associated with RF communication links were investigated in detail. Concrete, wood, various construction materials, and building walls were examined to assess indoor propagation capabilities. Data transmission through random trees, buildings, foliage under various atmospheric conditions is also evaluated for outdoor system capabilities. A maximum free space range for acceptable IR image transferring is determined as 23 miles for line of sight (LOS). Non line of sight (NLOS) urban environment measurements revealed that urban path loss (15-60 dBm) is highly dependent on antenna orientation and obstruction geometry rather than the T-R separation distance.

DTIC

Electromagnetic Wave Transmission; Infrared Imagery; Reliability Analysis; Wireless Communication

20050201024 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Testing of the Bio-Seeq (Smiths Detection Handheld PCR Instrument): Sensitivity, Specificity, and Effect of Interferents on Yersinia Pestis Assay Performance

O'Connell, Kevin P.; Anderson, Patricia E.; Valdes, James J.; Bucher, Jennifer R.; Apr. 2005; 25 pp.; In English

Report No.(s): AD-A435765; ECBC-TR-437; No Copyright; Avail: CASI; [A03](#), Hardcopy

Smiths Detection-Edgewood (SDE), Inc., recently developed a handheld PCR instrument, the Bio-Seeq(Federal Registration), an updated, redesigned version of a small, portable PCR instrument previously known as Handheld Advanced Nucleic Acid Analyzer (HANAA). The SDE developed the Bio-Seeq(Federal Registration) to provide a portable platform for use by first responders to detect biological threats in civilian areas. To be ready for introduction into the marketplace, the instrument must be accompanied by a menu of reagents that will enable the user to detect the presence of pathogens in environmental samples. In previous work, SDE obtained probe and primer sequences constituting an assay for a gene present in Yersinia pestis, the causative agent of plague. The SDE incorporated this probe and primer set into dried reagent beads, which also contain reagents required for an internal control. These, in turn, are part of a self-contained sampling device that contains buffer and the PCR reagent beads. This report details an analysis of the assay for Y. pestis, including the sensitivity and specificity of the assay, and the effect of some common non-target (interferent) materials on the performance of the assay.

DTIC

Assaying; Biological Effects; Detection; Sensitivity

20050201588 Naval Undersea Warfare Center, Newport, RI USA

Time Keyed Information Transmission

Amidon, Charles P., Inventor; Mar. 2005; 14 pp.; In English

Report No.(s): AD-D020203; No Copyright; Avail: CASI; [A03](#), Hardcopy

A method and apparatus is described for enabling a single sensor to indicate a greater quantity of information about a sensed event, or the occurrence of many different types of events. A sensor system employs a number of individual sensors with single-use indication means (such as an explosive charge). Each individual sensor is equipped with a chronometer. The sensors are programmed to transmit information through their single-use indication means at specific times with each specific time being indicative of a particular type of event or of specific information about an event. A central monitor chronologically records all sensor indications and compares indication times to a schedule of time keyed information to determine the nature of each sensor indication.

DTIC

Data Transmission; Detectors; Vents

20050201594 Naval Undersea Warfare Center, Newport, RI USA

Man Overboard Beacon

Frank, Thomas A., Inventor; Feb. 2005; 12 pp.; In English

Report No.(s): AD-D020209; No Copyright; Avail: CASI; [A03](#), Hardcopy

A user worn man overboard beacon that provides multiple indication means to alert a ship to an overboard crew person and to assist in locating the crew person. The beacon device is contained in a housing attached to the clothing of the sailor and is activated upon contact with seawater. A battery powers the multiple indicators contained in the housing, which include a high intensity strobe light to provide a visual indication, an x-band radar patch antenna to transmit a radar signal indication that can be detected by the ship's radar system, and an acoustic transducer to project an acoustic signal indication that can be detected by the ship's sonar system.

DTIC

Beacons; Signal Transmission; Sound Waves; Visual Signals

20050201611 Massachusetts Inst. of Tech., Cambridge, MA USA

Direct Manufacture of Components with Local Control of Composition

Sachs, Emanuel; Jun. 2005; 46 pp.; In English

Contract(s)/Grant(s): N00014-01-1-1065

Report No.(s): AD-A435176; No Copyright; Avail: CASI; [A03](#), Hardcopy

One of the great potentials of Solid Freeform Fabrication (SFF) is the ability to create parts which have different composition in different locations. This capability stems from the fundamental additive nature of SFF technologies. Three Dimensional Printing in particular is extremely flexible in this regard as material composition can be controlled not only between layers but also within a layer by printing different materials into different locations in the layer. The purpose of this work was to explore the potential of 3D Printing to create two different classes of components with local control of composition; gradient index lenses (GRIN) and metallic components with local composition control. These two classes of application are complimentary in that the GRIN lenses were made of glasses and were fabricated from extremely fine powders handled in a slurry form while the metallic components were fabricated from larger powders that can be dry processed.

DTIC

Image Enhancement; Printing

20050203727 Johns Hopkins Univ., Laurel, MD, USA

Predicting and Measuring the Dynamic Response of the CRISM Instrument

Schaefer, Edward D.; Tomkiewicz, Robert L.; 23rd Space Simulation Conference Proceedings; [2005]; 1 pp.; In English; See also 20050203713; No Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper discusses both the dynamic analysis and testing aspects for qualifying the CRISM instrument. The CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) instrument is a visible-infrared hyper-spectral instrument for NASA's Mars Reconnaissance Orbiter (MRO) spacecraft which is scheduled for launch 2005. The CRISM instrument was designed, analyzed and tested to take advantage of the force limiting qualification technique. Force limiting is the process by which the interface forces between the instrument and the electro-dynamic shaker are limited to what is likely to occur when the instrument is mounted on the spacecraft structure. Once in space the CRISM instrument utilizes a reciprocating a cryo-cooler to maintain the temperature of the infrared detector at 77 degrees (K). This cryo-cooler generates many harmonics

and sub-harmonics of the fundamental. This paper will discuss how these disturbance forces and moments were derived, using signal analysis software.

Author

Imaging Spectrometers; Dynamic Response; Mars Probes; Dynamic Tests; Spacecraft Instruments

20050203990 NASA Glenn Research Center, Cleveland, OH, USA

Quantitative Multi-Scalar Raman Scattering Diagnostics in High-Pressure Flames

Nguyen, Quang-Viet; Kojima, Jun; July 19, 2004; 1 pp.; In English; 30th International Combustion Symposium, 25-30 Jul. 2005, Chicago, IL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-714-20-05; No Copyright; Avail: CASI; [A01](#), Hardcopy

This poster presentation contains viewgraphs which summarize the design, operation, and resulting data of a Raman scattering diagnostic system for spectroscopy of high pressure flames.

CASI

Diagnosis; Raman Spectra; Combustion Physics; Flames; High Pressure; Spectrometers

36

LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20050200912 Naval Postgraduate School, Monterey, CA USA

High Energy Laser Applications in a Surface Combatant: Terminal Phase Theater Ballistic Missile Defense, Low Atmosphere Propagation, and Free Electron Laser Gain

Niles, Sean P.; Jun. 2005; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435558; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Free Electron Laser (FEL) can provide the naval surface combatant with a directed energy weapon that can be used against a large target set. Due to space constraints in a shipboard installation, an exploration is conducted to show the feasibility of short Rayleigh length FELs using a FEL simulation. Low atmosphere engagements are discussed through the modeling of a turbulence module for laser propagation in cruise missile defense applications. In particular, this thesis explores the difficulties in engaging a short/medium range theater ballistic missile (TBM) in the terminal phase as an engagement scenario in support of littoral operations using HELCoMES, developed by SAIC, as an engagement analysis tool. A concept of operations (CONOPS) for the use of a FEL as an area. TBM defensive weapon is explored, using a unitary, high explosive warhead model and extrapolations to other TBM warhead types.

DTIC

Ballistic Missiles; Free Electron Lasers; High Power Lasers; Laser Applications; Laser Outputs; Missile Defense; Navy; Warfare; Weapon Systems

20050201034 Ohio State Univ., Columbus, OH USA

Metallurgical Factors Influencing Direct Laser Deposition of Metallic Powers for Unitized Structures

Fraser, Hamish L.; Williams, James C.; Jan. 2005; 14 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0047

Report No.(s): AD-A435779; AFRL-SR-AR-TR-05-0292; No Copyright; Avail: CASI; [A03](#), Hardcopy

The aim of this project is to investigate the possibility of making use of direct laser deposition techniques for the production of unitized structures. Specifically, the research is directed at determining the metallurgical factors that influence the process for this application. By so doing, it is intended to develop technologies which permit exploitation of the advantages of this processing technique. This research that has been performed during the scope of this program has been considerable. Specifically, the research has been focused on process optimization and baseline property determination, graded compositions and the development of an associated combinatorial approach, the use of elemental blends, and the use of forging preforms. These represent the four primary research areas in this program, as described in the narrative below.

DTIC

Deposition; Laser Deposition; Lasers

20050201037 Michigan Univ., Ann Arbor, MI USA

Femtosecond Laser Assisted Health Monitoring of Critical Structural Components

Yalisove,; Jan. 2004; 3 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0136; Proj-Q908

Report No.(s): AD-A435785; AFRL-SR-AR-TR-05-0278; No Copyright; Avail: CASI; [A01](#), Hardcopy

STUDY of COLLATERAL DAMAGE to TURBINE BLADE MATERIALS DURING HIGH INTENSITY ULTRAFAST LASER INTERACTION FEASIBILITY STUDY of LASER INDUCED BREAKDOWN; SPECTROSCOPY (LIBS) IN ASSESSMENT of TURBINE BLADE HEALTH; FEASIBILITY STUDY of TERAHERTZ SPECTROSCOPY of DETERMINATION of THERMAL BARRIER COATING THICKNESS; FEASIBILITY STUDY of TURBINE BLADE RADIOGRAPHY USING ULTRAFAST LASER GENERATED X-RAYS.

DTIC

Health; Lasers; Protective Coatings; Structural Design

20050201068 Air Force Research Lab., Edwards AFB, CA USA

Direct Impulse Measurements of Ablation Processes from Laser-Surface Interactions

D'Souza, Brian; Ketsdever, Andrew; May 2005; 10 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A435844; No Copyright; Avail: Defense Technical Information Center (DTIC)

A torsional impulse balance has been developed as a new diagnostic tool to study fundamental processes in laser-surface interactions. Of particular interest are the forces due to processes of laser ablation. With respect to the transfer of momentum, direct measurements of the transient forces can lead to a better understanding and characterization of the efficiency of the impulse that is possible under different configurations. The impulse balance has been designed and tested with a robust calibration system to measure impulsive forces with resolution as low as several nano-Newton-seconds. Initial results of impulses due to ablation from an Nd:YAG laser (532nm) on various metals and other materials are presented.

DTIC

Ablation; Electromagnetic Interactions; Impulses; Lasers; Surface Reactions

37

MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20050199723 NASA Glenn Research Center, Cleveland, OH, USA, Lockheed Corp., USA

Design and Fabrication of a Stirling Thermal Vacuum Test

Oriti, Salvatore M.; [2004]; 16 pp.; In English; International Energy Conversion Engineering Conference (IECEC-2004), 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): 22-972-20-01; No Copyright; Avail: CASI; [A03](#), Hardcopy

A Stirling Radioisotope Generator (SRG110) is being developed for potential use on future NASA space science missions. The development effort is being conducted by Lockheed Martin under contract to the Department of Energy (DOE). The Stirling Technology Company supplies the free-piston Stirling power convertors, and NASA Glenn Research Center (GRC) provides support to the effort in a range of technologies. This generator features higher efficiency and specific power compared to the currently used alternatives. One potential application for the generator would entail significant cruise time in the vacuum of deep space. A test has been conceived at GRC to demonstrate functionality of the Stirling convertors in a thermal vacuum environment. The test article resembles the configuration of the SRG, however the requirement for low mass was not considered. This test will demonstrate the operation of the Stirling convertors in the thermal vacuum environment, simulating deep space, over an extended period of operation. The analysis, design, and fabrication of the test article will be described in this paper.

Author

Fabrication; Thermal Vacuum Tests; Optimization; Radioisotope Heat Sources; Generators; Stirling Engines; Free-Piston Engines

20050199728 NASA Glenn Research Center, Cleveland, OH, USA, Mohawk Innovative Technology, Inc., NY, USA, Williams International, Walled Lake, MI, USA

Oil-Free Turbomachinery Team Passed Milestone on Path to the First Oil-Free Turbine Aircraft Engine

Bream, Bruce L.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Oil-Free Turbine Engine Technology Project team successfully demonstrated a foil-air bearing designed for the core rotor shaft of a turbine engine. The bearings were subjected to test conditions representative of the engine core environment through a combination of high speeds, sustained loads, and elevated temperatures. The operational test envelope was defined during conceptual design studies completed earlier this year by bearing manufacturer Mohawk Innovative Technologies and the turbine engine company Williams International. The prototype journal foil-air bearings were tested at the NASA Glenn Research Center. Glenn is working with Williams and Mohawk to create a revolution in turbomachinery by developing the world's first Oil-Free turbine aircraft engine. NASA's General Aviation Propulsion project and Williams International recently developed the FJX-2 turbofan engine that is being commercialized as the EJ-22. This core bearing milestone is a first step toward a future version of the EJ-22 that will take advantage of recent advances in foil-air bearings by eliminating the need for oil lubrication systems and rolling element bearings. Oil-Free technology can reduce engine weight by 15 percent and let engines operate at very high speeds, yielding power density improvements of 20 percent, and reducing engine maintenance costs. In addition, with NASA coating technology, engines can operate at temperatures up to 1200 F. Although the project is still a couple of years from a full engine test of the bearings, this milestone shows that the bearing design exceeds the expected environment, thus providing confidence that an Oil-Free turbine aircraft engine will be attained. The Oil-Free Turbomachinery Project is supported through the Aeropropulsion Base Research Program.

Author

Aircraft Engines; Turbomachinery; Gas Bearings; General Aviation Aircraft; Turbine Engines

20050201777 Murcia Univ., Spain

easyTransport: An Interoperable and Secure e-ticketing Model based on Contactless Smart Cards

GomezSkarmeta, Antonio F.; MartinezPerez, Gregorio; YagoSanchez, Carmen M.; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 29-35; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

The introduction and use of electronic ticketing (e-ticketing) is an element of key importance for the good deployment of the public and private transport area across the world. In fact, it not only produces benefits for passenger transport operators, but it also creates an infrastructure, especially in urban areas, which can be used easily by other sectors. The use of secure infrastructures to support the payment and management of such kind of e-services is a growing area of interest. This article provides an overview of the current state of the art regarding e-ticketing systems, mainly in Europe, and describes a new proposed architecture, named easyTransport, based on the use of contactless smart cards, and where important items for an e-ticketing schema are in place, such as, ease of use, interoperability, standard-based, and multi-application.

Author

Electronic Control; Interoperability; Cards; Mathematical Models; Systems Engineering; Transportation

20050201888 NASA Glenn Research Center, Cleveland, OH, USA, Stirling Technology Co., Kennewick, WA, USA, Russian Inst. for Aviation Materials, Moscow, Russia

Integrated Stirling Convertor and Hall Thruster Test Conducted

Mason, Lee S.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

An important aspect of implementing Stirling Radioisotope Generators on future NASA missions is the integration of the generator and controller with potential spacecraft loads. Some recent studies have indicated that the combination of Stirling Radioisotope Generators and electric propulsion devices offer significant trip time and payload fraction benefits for deep space missions. A test was devised to begin to understand the interactions between Stirling generators and electric thrusters. An electrically heated RG-350 (350-W output) Stirling convertor, designed and built by Stirling Technology Company of Kennewick, Washington, under a NASA Small Business Innovation Research agreement, was coupled to a 300-W SPT-50 Hall-effect thruster built for NASA by the Moscow Aviation Institute (RIAME). The RG-350 and the SPT-50 shown, were installed in adjacent vacuum chamber ports at NASA Glenn Research Center's Electric Propulsion Laboratory, Vacuum Facility 8. The Stirling electrical controller interfaced directly with the Hall thruster power-processing unit, both of which were located outside of the vacuum chamber. The power-processing unit accepted the 48 Vdc output from the Stirling controller and distributed the power to all the loads of the SPT-50, including the magnets, keeper, heater, and discharge. On February 28, 2001, the Glenn test team successfully operated the Hall-effect thruster with the Stirling convertor. This is the world's first known test of a dynamic power source with electric propulsion. The RG-350 successfully managed the transition from the

purely resistive load bank within the Stirling controller to the highly capacitive power-processing unit load. At the time of the demonstration, the Stirling convertor was operating at a hot temperature of 530 C and a cold temperature of -6 C. The linear alternator was producing approximately 250 W at 109 Vac, while the power-processing unit was drawing 175 W at 48 Vdc. The majority of power was delivered to the Hall thruster discharge circuit operating at 115 Vdc and 0.9 A. Testing planned for late 2001 will examine the possibility of directly driving the Hall thruster discharge circuit using rectified and filtered output from the Stirling alternator.

Author

Stirling Cycle; Converters; Hall Thrusters; Test Facilities

20050201895 NASA Glenn Research Center, Cleveland, OH, USA

Overall Traveling-Wave-Tube Efficiency Improved By Optimized Multistage Depressed Collector Design

Vaden, Karl R.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Depressed Collector Design The microwave traveling wave tube (TWT) is used widely for space communications and high-power airborne transmitting sources. One of the most important features in designing a TWT is overall efficiency. Yet, overall TWT efficiency is strongly dependent on the efficiency of the electron beam collector, particularly for high values of collector efficiency. For these reasons, the NASA Glenn Research Center developed an optimization algorithm based on simulated annealing to quickly design highly efficient multistage depressed collectors (MDC's). Simulated annealing is a strategy for solving highly nonlinear combinatorial optimization problems. Its major advantage over other methods is its ability to avoid becoming trapped in local minima. Simulated annealing is based on an analogy to statistical thermodynamics, specifically the physical process of annealing: heating a material to a temperature that permits many atomic rearrangements and then cooling it carefully and slowly, until it freezes into a strong, minimum-energy crystalline structure. This minimum energy crystal corresponds to the optimal solution of a mathematical optimization problem. The TWT used as a baseline for optimization was the 32-GHz, 10-W, helical TWT developed for the Cassini mission to Saturn. The method of collector analysis and design used was a 2-1/2-dimensional computational procedure that employs two types of codes, a large signal analysis code and an electron trajectory code. The large signal analysis code produces the spatial, energetic, and temporal distributions of the spent beam entering the MDC. An electron trajectory code uses the resultant data to perform the actual collector analysis. The MDC was optimized for maximum MDC efficiency and minimum final kinetic energy of all collected electrons (to reduce heat transfer). The preceding figure shows the geometric and electrical configuration of an optimized collector with an efficiency of 93.8 percent. The results show the improvement in collector efficiency from 89.7 to 93.8 percent, resulting in an increase of three overall efficiency points. In addition, the time to design a highly efficient MDC was reduced from a month to a few days. All work was done in-house at Glenn for the High Rate Data Delivery Program. Future plans include optimizing the MDC and TWT interaction circuit in tandem to further improve overall TWT efficiency.

Author

Accumulators; Optimization; Traveling Wave Tubes; Algorithms; Mechanical Engineering

20050201898 NASA Glenn Research Center, Cleveland, OH, USA

Ti-48Al-2Cr-2Nb Evaluated Under Fretting Conditions

Miyoshi, Kazuhisa; Lerch, Bradley A.; Draper, Susan L.; Raj, Sai V.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Material parameters govern many of the design decisions in any engineering task. When two materials are in contact and microscopically small, relative motions (either vibratory or creeping) occur, and fretting fatigue can result. Fretting fatigue is a material response influenced by the materials in contact as well as by such variables as loading and vibratory conditions. Fretting produces fresh, clean interacting surfaces and induces adhesion, galling, and wear in the contact zone. Time, money, and materials are unnecessarily wasted when galling and wear result in excessive fretting fatigue that leads to poorly performing, unreliable mechanical systems. Fretting fatigue is a complex problem of significant interest to aircraft engine manufacturers. It can occur in a variety of engine components. Numerous approaches, depending on the component and the operating conditions, have been taken to address the fretting problems. The components of interest in this investigation were the low-pressure turbine blades and disks. The blades in this case were titanium aluminide, Ti-48Al-2Cr- 2Nb, and the disk was a nickel-base superalloy, Inconel 718 (IN 718). A concern for these airfoils is the fretting in fitted interfaces at the dovetail where the blade and disk are connected. Careful design can reduce fretting in most cases, but not completely eliminate it, because the airfoils frequently have a skewed (angled) blade-disk dovetail attachment, which leads to a complex stress state. Furthermore, the local stress state becomes more complex when the influence of the metal-metal contact and the edge of contact are considered.

Derived from text

Fretting; Mechanical Properties; Titanium Aluminides

20050201899 NASA Glenn Research Center, Cleveland, OH, USA

Thermal Cyclic Behavior of Thermal and Environmental Barrier Coatings Investigated Under High-Heat-Flux Conditions

Zhu, Dongming; Lee, Kang N.; Miller, Robert A.; Research and Technology 2001; March 2002; 5 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Environmental barrier coatings (EBC's) have been developed to protect silicon-carbide- (SiC) based ceramic components in gas turbine engines from high-temperature environmental attack. With continuously increasing demands for significantly higher engine operating temperature, future EBC systems must be designed for both thermal and environmental protection of the engine components in combustion gases. In particular, the thermal barrier functions of EBC's become a necessity for reducing the engine-component thermal loads and chemical reaction rates, thus maintaining the required mechanical properties and durability of these components. Advances in the development of thermal and environmental barrier coatings (TBC's and EBC's, respectively) will directly impact the successful use of ceramic components in advanced engines. To develop high-performance coating systems, researchers must establish advanced test approaches. In this study, a laser high-heat-flux technique was employed to investigate the thermal cyclic behavior of TBC's and EBC's on SiC-reinforced SiC ceramic matrix composite substrates (SiC/SiC) under high thermal gradient and thermal cycling conditions. Because the laser heat flux test approach can monitor the coating's real-time thermal conductivity variations at high temperature, the coating thermal insulation performance, sintering, and delamination can all be obtained during thermal cycling tests. Plasma-sprayed yttria-stabilized zirconia (ZrO₂-8 wt% Y₂O₃) thermal barrier and barium strontium aluminosilicate-based environmental barrier coatings (BSAS/BSAS+mullite/Si) on SiC/SiC ceramic matrix composites were investigated in this study. These coatings were laser tested in air under thermal gradients (the surface and interface temperatures were approximately 1482 and 1300 C, respectively). Some coating specimens were also subject to alternating furnace cycling (in a 90-percent water vapor environment at 1300 C) and laser thermal gradient cycling tests (in air), to investigate the water vapor effect. All cyclic tests were conducted using a 60-min hot-time temperature.

Author

Thermal Cycling Tests; Chemical Reactions; High Temperature; Temperature Effects; Protective Coatings

20050201905 NASA Glenn Research Center, Cleveland, OH, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA

Facility and Methods Developed for Simulated Space Vacuum Ultraviolet Exposure Testing of Polymer Films

Dever, Joyce A.; Pietromica, Anthony J.; Stueber, Thomas J.; Sechkar, Edward A.; Messer, Russell K.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Vacuum ultraviolet (VUV) radiation of wavelengths between 115 and 200 nm produced by the Sun in the space environment can degrade polymer films, producing changes in their optical, mechanical, and chemical properties. These effects are particularly important for thin polymer films being considered for ultralightweight space structures, because, for most polymers, VUV radiation is absorbed in a thin surface layer. The NASA Glenn Research Center has developed facilities and methods for long-term ground testing of polymer films to evaluate space environmental VUV radiation effects. VUV exposure can also be used as part of combined or sequential simulated space environmental exposures to determine combined damaging effects with other aspects of the space environment, which include solar ultraviolet radiation, solar flare x-rays, electron and proton radiation, atomic oxygen (for low-Earth-orbit missions), and temperature effects. Because the wavelength sensitivity of VUV damage is not well known for most materials, Glenn's VUV facility uses a broad-spectrum deuterium lamp with a magnesium fluoride window that provides output between 115 and 200 nm. Deuterium lamps of this type were characterized by the National Institute of Standards and Technology and through measurements at Glenn. Spectral irradiance measurements show that from approximately 115 to 160 nm, deuterium lamp irradiance can be many times that of air mass zero solar irradiance, and as wavelength increases above approximately 160 nm, deuterium lamp irradiance decreases in comparison to the Sun. The facility is a cryopumped vacuum chamber that achieves a system pressure of approximately 5310(exp -6) torr. It contains four individual VUV-exposure compartments in vacuum, separated by water-cooled copper walls to minimize VUV radiation and any sample contamination cross interactions between compartments. Each VUV-exposure compartment contains a VUV deuterium lamp, a motor-controlled sample stage coupled with a moveable cesium iodide VUV phototube, and two thermocouples for temperature measurement. The vacuum chamber and exterior equipment is shown. Each VUV lamp is located at the top of the chamber with its projection-tube pushed through an O-ring compression fitting. The lamp assemblies are located on ports that can be isolated from the rest of the vacuum chamber, permitting maintenance or replacement of the lamps without breaking vacuum in the main chamber where the samples are located. A view of two of the four interior VUV-exposure compartments, including the moveable sample stages and detector holders is also shown. Glenn is using this facility to support testing of Next Generation Space Telescope sunshield materials that is being led by the NASA

Goddard Space Flight Center and to develop an understanding of the wavelength, intensity, and temperature dependence of VUV-induced polymer degradation.

Derived from text

Ultraviolet Radiation; Vacuum Chambers; Polymers; Simulation; Thin Films

20050202004 Lawrence Livermore National Lab., Livermore, CA USA

X-Ray Absorption Characterization of Diesel Exhaust Particulates

Nelson, A. J.; Ferreira, J. L.; Reynolds, J. G.; Nov. 18, 1999; 12 pp.; In English

Report No.(s): DE2005-15013354; UCRL-JC-136533; No Copyright; Avail: Department of Energy Information Bridge

We have characterized particulates from a 1993 1 1.1 Detroit Diesel Series 60 engine with electronic unit injectors operated using fuels with and without methylcyclopentadienyl manganese tricarbonyl (MMT) and overbased calcium sulfonate added. X-ray photoabsorption (XAS) spectroscopy was used to characterize the diesel particulates. Results reveal a mixture of primarily Mn-phosphate with some Mn-oxide, and Ca-sulfate on the surface of the filtered particulates from the diesel engine.

NTIS

Combustion Products; Diesel Engines; Exhaust Emission; Exhaust Gases; Particulates; X Ray Absorption

20050202076 NASA Glenn Research Center, Cleveland, OH, USA

High-Temperature Gas Sensor Array (Electronic Nose) Demonstrated

Hunter, Gary W.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The ability to measure emissions from aeronautic engines and in commercial applications such as automotive emission control and chemical process monitoring is a necessary first step if one is going to actively control those emissions. One single sensor will not give all the information necessary to determine the chemical composition of a high-temperature, harsh environment. Rather, an array of gas sensor arrays--in effect, a high-temperature electronic 'nose'--is necessary to characterize the chemical constituents of a diverse, high-temperature environment, such as an emissions stream. The signals produced by this nose could be analyzed to determine the constituents of the emission stream. Although commercial electronic noses for near-room temperature applications exist, they often depend significantly on lower temperature materials or only one sensor type. A separate development effort necessary for a high-temperature electronic nose is being undertaken by the NASA Glenn Research Center, Case Western Reserve University, Ohio State University, and Makel Engineering, Inc. The sensors are specially designed for hightemperature environments. A first-generation high-temperature electronic nose has been demonstrated on a modified automotive engine. This nose sensor array was composed of sensors designed for hightemperature environments fabricated using microelectromechanical-systems- (MEMS-) based technology. The array included a tin-oxide-based sensor doped for nitrogen oxide (NOx) sensitivity, a SiC-based hydrocarbon (CxHy) sensor, and an oxygen sensor (O2). These sensors operate on different principles--resistor, diode, and electrochemical cell, respectively--and each sensor has very different responses to the individual gases in the environment. A picture showing the sensor head for the array is shown in the photograph on the left and the sensors installed in the engine are shown in the photograph on the right. Electronics are interfaced with the sensors for temperature control and signal conditioning, and packaging designed for high temperatures is necessary for the array to survive the engine environment.

Author

Gas Detectors; Chemical Composition; Microelectromechanical Systems; High Temperature Environments; Nitrogen Oxides; Exhaust Emission

20050203749 Army Research Lab., Cleveland, OH, USA

Comparison Made of Operating Characteristics of Spiral Bevel Gears Manufactured Using Different Methods

Handschuh, Robert F.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Spiral bevel gears are important components on all current rotorcraft drive systems. These components are required to operate at high speeds, high loads, and for an extremely large number of load cycles. In this application, spiral bevel gears are used to redirect the shaft from the horizontal gas turbine engine to the vertical rotor. Because of the high expense of manufacturing these gears, methods that can achieve the same level of performance at reduced cost are highly desirable to aerospace gear manufacturers. Gears manufactured for aerospace applications use high-quality materials and are manufactured to tight tolerances. Special manufacturing machine tools and computer numerically controlled coordinate measurement systems have enabled rotorcraft drive system manufacturers to produce extremely high-quality gears during their normal

production. Because of low production rates for rotorcraft, these gears are manufactured in small batches, and thus are unable to benefit from the economics of high production numbers as in other industries. In this investigation, two different manufacturing methods, face-milled and face-hobbed, were used to fabricate spiral bevel gears. For face-milled spiral bevel gears, grinding of the contacting surfaces is the final manufacturing step. At least two different specialty machines are needed to generate the teeth for face-milled spiral bevel gears. For face-hobbed gears, hard cutting is the final manufacturing process. The same machine is used to rough cut and finish cut the gears. This study compared the operational behavior of face-milled spiral bevel gears with that of face-hobbed spiral bevel gears. Test hardware was manufactured to fit within NASA Glenn Research Center's Spiral Bevel Test Facility and to aerospace quality standards. Tests were conducted for stress, vibration, and noise. A comparison of the results attained indicated that the face-hobbed gears had a lower alternating stress level with a more even distribution of loading across the teeth, and slightly reduced levels of vibration and noise. Results of this study show that the face-hobbed method is a viable and lower-cost alternative for producing aerospace-quality spiral-bevel gears.

Author

Manufacturing; Shafts (Machine Elements); Spiral Bevel Gears; Aerospace Engineering; Test Facilities

20050203751 NASA Glenn Research Center, Cleveland, OH, USA

Gear Crack Propagation Path Studies-- Guidelines Developed for Ultrasafe Design

Lewicki, David G.; Research and Technology 2001; March 2002; 5 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Effective gear designs balance strength, durability, reliability, size, weight, and cost. However, unexpected gear failures may occur even with adequate gear tooth design. To design an extremely safe system, the designer must ask and address the question 'What happens when a failure occurs?' With regard to gear-tooth bending fatigue, tooth or rim fractures may occur. For aircraft, a crack that propagated through a rim would be catastrophic, leading to the disengagement of a rotor or propeller, the loss of an aircraft, and possible fatalities. This failure mode should be avoided. However, a crack that propagated through a tooth might or might not be catastrophic, depending on the design and operating conditions. Also, early warning of this failure mode might be possible because of advances in modern diagnostic systems. An analysis was performed at the NASA Glenn Research Center to develop design guidelines to prevent catastrophic rim fracture failure modes in the event of gear-tooth bending fatigue. The finite element method was used with principles of linear elastic fracture mechanics. Crack propagation paths were predicted for a variety of gear tooth and rim configurations. The effects of rim and web thicknesses, initial crack locations, and gear-tooth geometry factors such as diametral pitch, number of teeth, pitch radius, and tooth pressure angle were considered. Design maps of tooth and rim fracture modes, including the effects of gear geometry, applied load, crack size, and material properties were developed. The occurrence of rim fractures significantly increased as the backup ratio (rim thickness divided by tooth height) decreased. The occurrence of rim fractures also increased as the initial crack location was moved down the root of the tooth. Increased rim and web compliance increased the occurrence of rim fractures. For gears with constant-pitch radii, coarser-pitch teeth increased the occurrence of tooth fractures over rim fractures. Also, 25 degree pressure angle teeth increased the occurrence of tooth fractures over rim fractures in comparison to 20 pressure angle teeth. For gears with a constant number of teeth or for gears with constant diametral pitch, varying size had little or no effect on crack propagation paths.

Author

Crack Propagation; Gear Teeth; Mechanical Engineering; Fracture Mechanics

20050203792 NASA Glenn Research Center, Cleveland, OH, USA

Gear Transmission Error Measurement System Made Operational

Oswald, Fred B.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A system directly measuring the transmission error between the meshing spur or helical gears was installed at the NASA Glenn Research Center and made operational in August 2001. This system employs light beams directed by lenses and prisms through gratings mounted on the two gear shafts. The amount of light that passes through both gratings is directly proportional to the transmission error of the gears. The device is capable of resolution better than 0.1 mm (one thousandth the thickness of a human hair). The measured transmission error can be displayed in a 'map' that shows how the transmission error varies with the gear rotation or it can be converted to spectra to show the components at the meshing frequencies. Accurate transmission error data will help researchers better understand the mechanisms that cause gear noise and vibration and will lead to The Design Unit at the University of Newcastle in England specifically designed the new system for NASA. It is the only device in the USA that can measure dynamic transmission error at high rotational speeds. The new system will be used

to develop new techniques to reduce dynamic transmission error along with the resulting noise and vibration of aeronautical transmissions.

Author

Errors; Mechanical Engineering; Gear Teeth; Transmissions (Machine Elements)

20050203794 NASA Glenn Research Center, Cleveland, OH, USA

Fail-Safe Operation of a High-Temperature Magnetic Bearing Investigated for Gas Turbine Engine Applications

Choi, Benjamin B.; Montague, Gerald T.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Structural Mechanics and Dynamics Branch at the NASA Glenn Research Center has developed a three-axis high-temperature magnetic bearing suspension rig to enhance the safety of the bearing system up to 1000 F. This test rig can accommodate thrust and radial bearings up to a 22.84 cm (9 in.) diameter with a maximum axial loading of 22.25 kN (5000 lb) and a maximum radial loading up to 4.45 kN (1000 lb). The test facility was set up to test magnetic bearings under high-temperature (1100 F) and high-speed (20,000 rpm) conditions. The magnetic bearing is located at the center of gravity of the rotor between two high-temperature grease-packed mechanical ball bearings. The drive-end duplex angular contact ball bearing, which is in full contact, acts as a moment release and provides axial stability. The outboard end ball bearing has a 0.015-in. radial clearance between the rotor to act as a backup bearing and to compensate for axial thermal expansion. There is a 0.020-in. radial air gap between the stator pole and the rotor. The stator was wrapped with three 1-kW band heaters to create a localized hot section; the mechanical ball bearings were outside this section. Eight threaded rods supported the stator. These incorporated a plunger and Bellville washers to compensate for radial thermal expansion and provide rotor-to-stator alignment. The stator was instrumented with thermocouples and a current sensor for each coil. Eight air-cooled position sensors were mounted outside the hot section to monitor the rotor. Another sensor monitored this rotation of the outboard backup bearing. Ground fault circuit interrupts were incorporated into all power amplifier loops for personnel safety. All instrumentation was monitored and recorded on a LabView-based data acquisition system. Currently, this 12-pole heteropolar magnetic bearing has 13 thermal cycles and over 26 hr of operation at 1000 F.

Derived from text

Magnetic Bearings; High Temperature; Gas Turbine Engines; Fail-Safe Systems

20050203859 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

The Stability of Two Connected Pendant Drops

Slobozhanin, Lev A.; Alexander, J. Iwan; [2004]; 2 pp.; In English; 21st International Conference on Theoretical and Applied Mechanics, 16-20 Aug. 2004, Warsaw, Poland; No Copyright; Avail: CASI; [A01](#), Hardcopy

The stability of an equilibrium system of two drops suspended from circular holes is examined. The drop surfaces are disconnected surfaces of a connected liquid body. For holes of equal radii and identical pendant drops axisymmetric perturbations are always the most dangerous. The stability region for two identical drops differs considerably from that for a single drop. Loss of stability leads to a transition from a critical system of identical drops to a stable system of axisymmetric non-identical. This system of non-identical drops reaches its own stability limit (to isochoric or non-isochoric perturbations). For non-identical drops, loss of stability results in dripping or streaming from the holes. Critical volumes for non-identical drops have been calculated as functions of the Bond number, B. For unequal hole radii, stability regions have been constructed for a set of hole radius, K. The dependence of critical volumes on K and B is analyzed.

Author

Hole Geometry (Mechanics); Stability; Drops (Liquids); Mechanical Engineering

20050203864 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Capillary Pressure of a Liquid Between Uniform Spheres Arranged in a Square-Packed Layer

Alexander, J. Iwan D.; Slobozhanin, Lev A.; Collicott, Steven H.; [2004]; 1 pp.; In English; International Conference on Theoretical and Applied Mechanics, 16-20 Aug. 2004, Warsaw, Poland; Original contains color illustrations
Contract(s)/Grant(s): NCC3-975; 22-101-58-09; Copyright; Avail: CASI; [A01](#), Hardcopy

The capillary pressure in the pores defined by equidimensional close-packed spheres is analyzed numerically. In the absence of gravity the menisci shapes are constructed using Surface Evolver code. This permits calculation the free surface mean curvature and hence the capillary pressure. The dependences of capillary pressure on the liquid volume constructed here for a set of contact angles allow one to determine the evolution of basic capillary characteristics under quasi-static infiltration and drainage. The maximum pressure difference between liquid and gas required for a meniscus passing through a pore is

calculated and compared with that for hexagonal packing and with approximate solution given by Mason and Morrow [1]. The lower and upper critical liquid volumes that determine the stability limits for the equilibrium capillary liquid in contact with square packed array of spheres are tabulated for a set of contact angles.

Author

Packing Density; Capillaries; Porosity; Menisci; Spheres; Drainage

20050203868 NASA Glenn Research Center, Cleveland, OH, USA

Solid Oxide Fuel Cell Seal Development at NASA Glenn Research Center

Steinetz, Bruce M.; Bansal, Narottam P.; Dynys, Fred W.; Lang, Jerry; Daniels, Christopher C.; Palko, Joeseeph L.; Choi, S. R.; [2004]; 4 pp.; In English; 2004 Fuel Cell Seminar, 1-5 Nov. 2004, San Antonio, TX, USA

Contract(s)/Grant(s): 22-708-31-01; No Copyright; Avail: CASI; [A01](#), Hardcopy

Researchers at NASA GRC are confronting the seal durability challenges of Solid Oxide Fuel Cells by pursuing an integrated and multidisciplinary development effort incorporating thermo-structural analyses, advanced materials, experimentation, and novel seal design concepts. The successful development of durable hermetic SOFC seals is essential to reliably producing the high power densities required for aerospace applications.

Author

Hermetic Seals; Solid Oxide Fuel Cells

38

QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20050199748 NASA Glenn Research Center, Cleveland, OH, USA

Preliminary Integrated Safety Analysis of Synthetic Vision Conducted

Reveley, Mary S.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The goal of the NASA Aviation Safety Program is to develop and demonstrate technologies that could help reduce the aviation fatal accident rate by a factor of 5 by the year 2007 and by a factor of 10 by the year 2022. Integrated safety analysis of day-to-day operations and risks within those operations will provide an understanding of the Aviation Safety Program portfolio beyond what is now available. Synthetic vision is the first of the Aviation Safety Program technologies that has been analyzed by the Logistics Management Institute under a contract with the NASA Glenn Research Center. These synthetic vision analyses include both a reliability analysis and a computer simulation model.

Derived from text

Enhanced Vision; Reliability Analysis; Flight Safety; Navigation Aids

20050201728 NVI, Inc., Greenbelt, MD, USA

Network Coordinator Report

Himwich, Ed; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 31-37; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

This report includes an assessment of the network performance in terms of the yield of usable data over a 12 month period. Overall, the data loss for 2004 was about 12.5%. A table of relative incidence of problems with various subsystems is presented. The most significant causes of data loss were antenna reliability (33%), receiver problems (18%), recorder problems (11%), and RFI (5-10%). The current situation for the handling of correlator clock adjustments by the correlators is reviewed. The adjustments are not currently handled in a consistent way and this has an impact on the UT1-UTC estimates from VLBI data. Some work will be required to correct this problem.

Author

Correlators; Very Long Base Interferometry; Reliability; Receivers; Losses

20050203886 NASA Glenn Research Center, Cleveland, OH, USA

Health Sensing Functions in Thermal Barrier Coatings Incorporating Rare-Earth-Doped Luminescent Sublayers

Eldridge, J. I.; Singh, J.; Wolfe, D. E.; July 2004; 1 pp.; In English; 29th International Conference on Advanced Ceramics and Composites, 23-28, Jan. 2005, Cocoa Beach, FL, USA

Contract(s)/Grant(s): 22IRD00003; No Copyright; Avail: CASI; [A01](#), Hardcopy

Great effort has been directed towards developing techniques to monitor the health of thermal barrier coatings (TBCs) that would detect the approach of safety-threatening conditions. An unconventional approach is presented here where health sensing functionality is integrated into the TBC itself by the incorporation of rare-earth-doped luminescent sublayers to monitor erosion as well as whether the TBC is maintaining the underlying substrate at a sufficiently low temperature. Erosion indication is demonstrated in electron-beam physical vapor deposited (EB-PVD) TBCs consisting of 7wt% yttria-stabilized zirconia (7YSZ) with europium-doped and terbium-doped sublayers. Multiple ingot deposition produced sharp boundaries between the doped sublayers without interrupting the columnar growth of the TBC. The TBC-coated specimens were subjected to alumina particle jet erosion, and the erosion depth was then indicated under ultraviolet illumination that excited easily visible luminescence characteristic of sublayer that was exposed by erosion. In addition, temperature measurements from a bottom-lying europium-doped sublayer in a TBC produced by multiple ingot EB-PVD were accomplished by measuring the temperature-dependent decay time from the 606 nm wavelength emission excited in that sublayer with a 532 nm wavelength laser that was selected for its close match to one of the europium excitation wavelengths as well as being at a wavelength where the TBC is relatively transparent. It is proposed the low dopant levels and absence of interruption of the TBC columnar growth allow the addition of the erosion and temperature sensing functions with minimal effects on TBC performance.

Author

Systems Health Monitoring; Thermal Control Coatings; Luminescence; Doped Crystals; Yttria-Stabilized Zirconia

39

STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20050201098 Army Construction Engineering Research Lab., Champaign, IL USA

Sustainable Project Rating Tool (SPiRiT), Version 1.4.1. Documentation Guide

Schneider, Richard; Fournier, Donald F.; Sep. 2004; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435916; ERDC/CERL-SR-04-28; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Sustainable Project Rating Tool (SPiRiT) was developed by the U.S. Army Engineer Research and Development Center (ERDC) as a measurement system for rating new and major renovations to institutional buildings. SPiRiT evaluates environmental performance from a whole building perspective over a building's life cycle and provides a definitive standard to assess the sustainability or 'green' attributes of the design-construct process for a given project. SPiRiT addresses critical areas of the design-construct process for seven categories or issues: site, water, energy usage, materials, indoor environmental quality, facility delivery, and current mission. The rating system consists of prerequisites and credits that when met provide points towards an overall score. The overall score is used to indicate one of four project certification levels-Bronze, Silver, Gold, and Platinum, indicating increasing levels of sustainability or 'greenness.' All Army Military Construction projects and major OMA projects must achieve a Bronze rating level. This work was undertaken to provide current documentation for SPiRiT version 1.4.1.

DTIC

Buildings; Computer Programs; Energy Conservation; Manuals; Ratings

20050201786 NASA Glenn Research Center, Cleveland, OH, USA

Tensile Strength and Microstructure of Al₂O₃-ZrO₂ Hypo-Eutectic Fibers Studied

Farmer, Serene C.; Sayir, Ali; Research and Technology 2000; March 2001; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Oxide eutectics offer high-temperature strength retention and creep resistance in oxidizing environments. Al₂O₃-ZrO₂ eutectic strengths have been studied since the 1970's. Directionally solidified oxide eutectics exhibit improved resistance to slow crack growth and excellent strength retention at high temperatures up to 1400 C. Materials studied typically contain Y₂O₃ to metastably retain the high-temperature cubic and tetragonal polymorphs at room temperature. Al₂O₃-ZrO₂ is of fundamental interest for creep studies because it combines a creep-resistant material, Al₂O₃, with a very low creep resistance material, ZrO₂. Results on mechanical properties and microstructures of these materials will be used to define compositions for creep testing in future work. Substantial variations from the eutectic alumina to zirconia ratio can be tolerated without a loss in room-temperature strength. The effect of increasing Y₂O₃ addition on the room-temperature tensile strength of an

Al₂O₃-ZrO₂ material containing excess Al₂O₃ was examined at the NASA Glenn Research Center, where the materials were grown using Glenn's world-class laser growth facilities.

Author

Crack Propagation; Zirconium Oxides; Eutectics; Fibers; Tensile Strength; Microstructure

20050201922 Technische Univ., Delft, Netherlands

HERON, Volume 49, No. 2

January 2004; 100 pp.; In English

Report No.(s): PB2005-107444; No Copyright; Avail: CASI; [A05](#), Hardcopy

Contents: Editorial: Ton Vrouwenvelder; Does more sophisticated modeling reduce model uncertainty. A case study on vibration predictions; Discounting for optimal and acceptable technical facilities involving risks; Towards a reliable design of facade and roof elements against wind loading; Bayesian estimation of design loads.

NTIS

Construction Industry; Loads (Forces); Vibration

20050203722 Lockheed Martin Astronautics, Denver, CO, USA

Force Limited Vibration Testing of Components

Foss, R.; 23rd Space Simulation Conference Proceedings; [2005]; 21 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Components mounted on launch vehicles during flight are subjected to random-vibration that is generally less than that replicated on a test shaker, even though the control acceleration on the shaker may match measured accelerations at the base of the component during flight. When there is flight excitation energy at the frequency that matches the component natural frequency (i.e. resonance), a local portion of the support structure mass participates in this mode of vibration and shares the resonance energy. When the same component is mounted on a shaker table with negligible mechanical impedance however, there is little sharing of energy at the mounting/component resonance leading to potentially severe over-test conditions. Limiting this test resonance response using Newton's second law of force is a technically defensible and verifiable way to control the over-test that results from mechanical impedance differences between flight mounting and shaker mounting conditions. There are circumstances however where the hardware modifications required to implement the force limits are neither cost effective or technically warranted, and this paper presents one such occurrence.

Author

Random Vibration; Vibration Tests; Resonant Frequencies; Vibration Damping

20050203840 NASA Langley Research Center, Hampton, VA, USA

Structural and Acoustic Damping Characteristics of Polyimide Microspheres

Palumbo, Daniel L.; Park, Junhong; [2005]; 13 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-781-10-13

Report No.(s): AIAA Paper 2005-2328; Copyright; Avail: CASI; [A03](#), Hardcopy

A broad range of tests have been performed to evaluate the capability of tiny lightweight polyimide spheres to reduce sound and vibration. The types of testing includes impedance tube measurement of propagation constant, sound power insertion loss for single and double wall systems, particle frame wave characterization and beam vibration reduction. The tests were performed using spheres made of two types of polyimide and with varying diameter. Baseline results were established using common noise reduction treatment materials such as fiberglass and foam. The spheres were difficult to test due to their inherent mobility. Most tests required some adaptation to contain the spheres. One test returned obvious non-linear behavior, a result which has come to be expected for treatments of this type. The polyimide spheres are found to be a competent treatment for both sound and vibration energy with the reservation that more work needs to be done to better characterize the non-linear behavior.

Author

Polyimides; Spherules; Acoustic Attenuation; Vibration Damping; Structural Analysis; Absorbers (Materials); Insertion Loss; Microparticles

20050203842 NASA Langley Research Center, Hampton, VA, USA

Structural Analysis for the American Airlines Flight 587 Accident Investigation: Global Analysis

Young, Richard D.; Lovejoy, Andrew E.; Hilburger, Mark W.; Moore, David F.; [2005]; 23 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-762-55-PI; No Copyright; Avail: CASI; [A03](#), Hardcopy

NASA Langley Research Center (LaRC) supported the National Transportation Safety Board (NTSB) in the American Airlines Flight 587 accident investigation due to LaRC's expertise in high-fidelity structural analysis and testing of composite structures and materials. A Global Analysis Team from LaRC reviewed the manufacturer's design and certification procedures, developed finite element models and conducted structural analyses, and participated jointly with the NTSB and Airbus in subcomponent tests conducted at Airbus in Hamburg, Germany. The Global Analysis Team identified no significant or obvious deficiencies in the Airbus certification and design methods. Analysis results from the LaRC team indicated that the most-likely failure scenario was failure initiation at the right rear main attachment fitting (lug), followed by an unstable progression of failure of all fin-to-fuselage attachments and separation of the VTP from the aircraft. Additionally, analysis results indicated that failure initiates at the final observed maximum fin loading condition in the accident, when the VTP was subjected to loads that were at minimum 1.92 times the design limit load condition for certification. For certification, the VTP is only required to support loads of 1.5 times design limit load without catastrophic failure. The maximum loading during the accident was shown to significantly exceed the certification requirement. Thus, the structure appeared to perform in a manner consistent with its design and certification, and failure is attributed to VTP loads greater than expected.

Author

Accident Investigation; Aircraft Accidents; Civil Aviation; Structural Analysis; Airline Operations

20050203873 Building and Construction Research TNO, Delft, Netherlands

NTP Effects of Nearby Explosions W4.2: Evaluation of CHINOOK for Nearby UNDEX Simulations

vandenEikhoff, J.; January 19, 2005; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): A04/CO/4WP; TNO Proj. 006.48251

Report No.(s): TD-2004-0274; Rept-2004-CMC-R068; Copyright; Avail: Other Sources

A prediction is made for the jetting loadings on a panel loaded at two distances. The gas bubble is clearly attracted by the plate during its contraction. At the bubble minimum, jetting occurs which results in a pressure pulse on the plate. Depending on the charge the bubble hits the plate after the first bubble contraction or before the bubble reaches its maximum volume. For the close charge it contracts against the plate in a ring. CHINOOK is incapable yet to analyse the similar problem with a flexible plate. This requires coupling to a Lagrangian structural finite element program such as LS-DYNA or VAST. One should keep alert on new possibilities to couple CHINOOK's Euler model of fluid and gas bubble to a structural model, e.g. within LS-DYNA, with the purpose to do coupled analyses. High speed underwater video recordings are the appropriate way of validating the calculated gas bubble oscillation and migration history. This should be attempted again in the future at a different test location.

Author

Ships; Underwater Explosions; Computerized Simulation; Computer Programs; Bubbles

20050203932 Sydney Univ., Australia

Action and Entropy in Complex Systems and Their Role in the Morphogenesis of Self-Assembling Structures

Kennedy, Ivan R.; Crossan, Angus; Geering, Harold; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 9 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The action resonance theory (ART) allows entropy to be estimated from a system's action, a material property equivalent to angular momentum, or spin, supplementing current experimental third-law measurements of the total thermal heat capacity, or estimation by statistical methods. As a corollary, ART proposes that sustainable morphologies in ecosystems depend on continuous balancing of action exchange forces generated by the quanta of different frequencies predicted by this estimation, with momenta corresponding to variations in energy diminishing by many orders of magnitude from nuclear to gravitational states. Such sustainability by the action field has profound significance for the stability of all self-assembling structures in biology and the environment, with implications for processes such as the folding of newly-engineered proteins in biotechnology to the vertical redistribution of atmospheric gases in global climate change. These cross-disciplinary

implications of ART and the unifying solutions it can provide to the problem of morphogenesis and all information flow providing structure in nature will be discussed.

Author

Entropy; Statistical Analysis; Angular Momentum; Complex Systems; Information Flow; Structural Engineering

42

GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20050201823 Dartmouth Coll., Hanover, NH, USA

On the Brittle Failure of Water Ice Ih: A Short Review

Schulson, E. M.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 1 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Ice, or more specifically water ice, occurs in a variety of forms, from terrestrial glaciers, floating ice sheets, and airborne particles to micrometeorites, icy satellites, and planetary polar caps. In each form its mechanical behavior is of interest, from the breakup of the Antarctic ice shelf and the Arctic sea ice cover against itself and against off-shore engineered structures, to impact by hailstones and falling ice, to the tectonic history of Europa, Ganymede and other extra-terrestrial bodies. In this presentation I will focus on ordinary or low-pressure ice Ih, which possesses hexagonal crystal symmetry, and will consider the mechanisms underlying the process of brittle failure under quasistatic strain rates, on scales large and small. My thesis is that failure on the larger scale, although complicated by inhomogeneities in stress state and in ice thickness distribution, is in essence governed by the same physics that operate on the smaller scale. I will support this position with evidence of wing cracks, comb cracks and Coulombic shear faults within the icy crust of Europa [1], the Arctic sea ice cover [2] and laboratory specimens [3], and I will present a simple analysis based upon independently-measurable physical parameters that accounts for the measured failure stress under a variety of stress states. I will also consider the ductile-to-brittle transition on scales large and small, and will account for the transition quantitatively in terms of the competition between the building up of internal stress at cracks and the relaxation of stress through creep. If time permits, I will close by showing that the mechanisms that govern the brittle compressive failure and the ductile-to-brittle transition of ice under both moderate and high confinement appear to account for the same phenomena in rocks and minerals, at least on the smaller scale [4].

Derived from text

Ice; Brittleness; Sea Ice; Glaciers; Icy Satellites; Polar Caps; Tectonics; Residual Stress; Mechanical Properties; Compressibility

43

EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20050200876 Scripps Institution of Oceanography, La Jolla, CA USA

Hierarchical Models of the Nearshore Complex System

Werner, Brad; Jan. 2004; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0358

Report No.(s): AD-A435474; No Copyright; Avail: Defense Technical Information Center (DTIC)

The long-term goal of this research was to develop and test predictive models for near shore processes. This grant was termination funding for the Werner group, specifically aimed at finishing up and publishing research related to synoptic imaging of near shore bathymetry, testing models for beach cusp formation and modeling sand bar evolution.

DTIC

Bathymeters; Beaches; Complex Systems

20050200976 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Cost and Performance Report Enhanced Biological Attenuation of Aircraft Deicing Fluid Runoff Using Constructed Wetlands

Knight, Robert L.; Clarke, Ronald; Apr. 2005; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435667; NFESC-TR-2261-ENV; No Copyright; Avail: Defense Technical Information Center (DTIC)

During winter months at Department of Defense (DOD) air bases, large amounts of aircraft deicing and anti-icing fluids (ADF) (primarily propylene glycol, ethylene glycol, and various additives) are used to ensure flight safety during certain adverse weather conditions. Standard practices at both military air bases and private airports are to direct deicing effluent to large stabilization ponds, the sanitary storm sewer, vegetated swales, or directly to the environment. The objective of this project was to demonstrate that SSF constructed treatment wetland (CTW) technology could cost-effectively remove harmful chemicals from deicing waste streams for immediate and long-term compliance with water quality regulations.

DTIC

Aircraft; Costs; Deicers; Deicing; Drainage; Fluids; Ice Prevention; Wetlands

20050200997 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Cost and Performance Report Multi-Site in Situ Air Sparging

Apr. 2005; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435719; NFESC-TR-2260-ENV; No Copyright; Avail: Defense Technical Information Center (DTIC)

The primary performance objective of this study was to implement the Air Sparging Design Paradigm at a number of existing air sparging sites and determine whether the Design Paradigm was effective at evaluating air distribution and whether other design guidelines were valid. The goal of the project was to modify the Air Sparging Design Paradigm as necessary based on results obtained from ten field sites. Results from this study have been used to finalize the Air Sparging Design Paradigm. Implementation of the Air Sparging Design Paradigm in the evaluation and design of air sparging systems will likely result in air sparging applications that are more cost-effective and in applications that have a better performance record. This document is intended to provide base environmental managers with a more standardized approach, which can be used to evaluate air sparging designs.

DTIC

Air; Contaminants; Costs; Injection; Soils

20050201112 Coastal Environments, Inc., Baton Rouge, LA USA

Houma Navigation Canal Deepening Project Terrebonne Parish, Louisiana: Cultural Resources Literature Search, Records Review and Research Design

Ryan, Joanne; Weinstein, Richard A.; Pearson, Charles E.; Mar. 2005; 163 pp.; In English

Contract(s)/Grant(s): DACW29-01-D-0016-0005

Report No.(s): AD-A435963; CEI-AR-549; No Copyright; Avail: CASI; [A08](#), Hardcopy

From October through December of 2003, Coastal Environments, Inc. (CEI), conducted a cultural resources literature search and records review as part of a U.S. Army Corps of Engineers (COE) New Orleans District re-evaluation study to determine if improvements to navigation along the Houma Navigation Canal, in Terrebonne Parish, Louisiana, are justified. These investigations are part of the planning to evaluate several alternatives to deepening the HNC from the authorized 15-foot depth to an 18- or 20-foot depth while maintaining the existing canal width. Both channel depths are being considered with a lock and without a lock in place. If the canal itself is assumed to be approximately 1000 ft (305m) wide, the HNC encompassed roughly 4969.69ac (2012.05ha), including 2909.09ac (1177.78ha) of canal and 2060.60ac (834.26ha) of navigation channel. Three previously recorded archaeological sites and 13 sunk or salvaged vessels exist within the project's Area of Potential Effects (APE). In addition, seven unrecorded sites and 23 potential site loci were noted on the HNC during the project area site inspection conducted during this study. Those portions of the project area with a high probability for containing cultural resources have been defined on project plans and encompass 691.48ac. A research design to guide future cultural resources fieldwork in the project area is presented.

DTIC

Archaeology; Canals; Cultural Resources; Navigation; Surveys

20050201661 Bear Creek Archeology, Inc., Decorah, IA USA

Phase II Archaeological Testing of the Helmkamp Site (11MS2025) in Support of the Proposed Grassy Lake Pump Station and Associated Ditch Work, Wood River Drainage and Levee District, Madison County, Illinois

Thompson, Joe B.; Benn, David W.; Apr. 2005; 143 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W912P9-04-P-1048

Report No.(s): AD-A435675; BCA-1199/1230; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report documents the findings of Phase II testing of 11MS2025, the Helmkamp site, in the northern American Bottom in Madison County, Illinois. The legal location of the site, which covers approximately .6 ha (1.4 ac.), is N1/2, SE1/4, SE1/4, SW1/4 and S1/2, NE1/4, SE1/4, SW1/4 of Section 11, T4N, R9W, Madison County, Illinois. Bear Creek Archeology, Inc., Cresco, IA, conducted the testing under contract with the St. Louis Corps of Engineers. A geomorphic investigation found that the site was situated on and buried within a natural levee. Using a systematic surface coupled with 52 bucket augers and 13 1x1 m test units, a light-to-moderate scatter of prehistoric artifacts, and two features were found from the surface to a depth of approximately 120-130 cm. The artifacts and features are associated with four cultural components dating to the Late Woodland, Early Woodland, probable middle to late Late Archaic, and early Late Archaic periods. The two Woodland components have been adversely affected by plowing and other disturbance, and no additional investigations are recommended. The two Archaic components, on the other hand, have greater integrity and contain a moderate scatter of artifacts (including diagnostic points) and cultural features.

DTIC

Archaeology; Drainage; Illinois; Lakes; Mississippi River (US); Rivers; Wood

20050202018 West Virginia Univ., Morgantown, WV, USA

Urban forms, physical activity and body mass index: a cross-city examination using ISS Earth Observation photographs

Lin, Ge; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 15-1 - 15-15; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Johnson Space Center has archived thousands of astronauts acquired Earth images. Some spectacular images have been widely used in news media and in k-12 class room, but their potential utilizations in health promotion and disease prevention have relatively untapped. The project uses daytime ISS photographs to define city forms and links them to city or metropolitan level health data in a multicity context. Road connectivity, landuse mix and Shannon's information indices were used in the classification of photographs. In contrast to previous remote-sensing studies, which tend to focus on a single city or a portion of a city, this project utilized photographs of 39 U.S. cities. And in contrast to previous health-promotion studies on the built environment, which tend to rely on survey respondents' responses to evaluate road connectivity or mixed land use for a single study site, the project examined the built environments of multiple cities based on ISS photos. It was found that road connectivity and landuse mix were not statistically significant by themselves, but the composite measure of the Shannon index was significantly associated with physical activity, but not BMI. Consequently, leisure-time physical activity seems to be positively associated with the urban complexity scale. It was also concluded that unless they are planned or designed in advance, photographs taken by astronauts generally are not appropriate for a study of a single-site built environment nor are they appropriate for a study of infectious diseases at a local scale. To link urban built environment with city-wide health indicators, both the traditional nadir view and oblique views should be emphasized in future astronauts' earth observation photographs.

Author

Earth Observations (From Space); Photographs; Observation

20050203649 Woods Hole Research Center, MA, USA

Spatial Predictive Modeling and Remote Sensing of Land Use Change in the Chesapeake Bay Watershed

Goetz, Scott J.; Bockstael, Nancy E.; Jantz, Claire A.; August 2005; 12 pp.; In English

Contract(s)/Grant(s): NAG5-13397; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project was focused on modeling the processes by which increasing demand for developed land uses, brought about by changes in the regional economy and the socio-demographics of the region, are translated into a changing spatial pattern of land use. Our study focused on a portion of the Chesapeake Bay Watershed where the spatial patterns of sprawl represent a set of conditions generally prevalent in much of the U.S. Working in the region permitted us access to (i) a time-series of multi-scale and multi-temporal (including historical) satellite imagery and (ii) an established network of collaborating partners and agencies willing to share resources and to utilize developed techniques and model results. In addition, a unique

parcel-level tax assessment database and linked parcel boundary maps exists for two counties in the Maryland portion of this region that made it possible to establish a historical cross-section time-series database of parcel level development decisions. Scenario analyses of future land use dynamics provided critical quantitative insight into the impact of alternative land management and policy decisions. These also have been specifically aimed at addressing growth control policies aimed at curbing exurban (sprawl) development. Our initial technical approach included three components: (i) spatial econometric modeling of the development decision, (ii) remote sensing of suburban change and residential land use density, including comparisons of past change from Landsat analyses and more traditional sources, and (iii) linkages between the two through variable initialization and supplementation of parcel level data. To these we added a fourth component, (iv) cellular automata modeling of urbanization, which proved to be a valuable addition to the project. This project has generated both remote sensing and spatially explicit socio-economic data to estimate and calibrate the parameters for two different types of land use change models and has undertaken analyses of these models. One (the CA model) is driven largely by observations on past patterns of land use change, while the other (the EC model) is driven by mechanisms of the land use change decision at the parcel level. Our project may be the first serious attempt at developing both types of models for the same area, using as much common data as possible. We have identified the strengths and weaknesses of the two approaches and plan to continue to revise each model in the light of new data and new lessons learned through continued collaboration. Questions, approaches, findings, publication and presentation lists concerning the research are also presented.

Derived from text

Chesapeake Bay (US); Land Use; Prediction Analysis Techniques; Remote Sensing; Satellite Imagery; Urban Development; Dynamic Models

20050203885 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Estimation of Length-Scales in Soils by MRI

Daidzic, N. E.; Altobelli, S.; Alexander, J. I. D.; [2004]; 1 pp.; In English; 7th International Conference on Magnetic Resonance in Porous Media (MRPM7), 4-8 Jul. 2004, Palaiseau, France; Copyright; Avail: CASI; [A01](#), Hardcopy

Soil can be best described as an unconsolidated granular media that forms porous structure. The present macroscopic theory of water transport in porous media rests upon the continuum hypothesis that the physical properties of porous media can be associated with continuous, twice-differentiable field variables whose spatial domain is a set of centroids of Representative Elementary Volume (REV) elements. MRI is an ideal technique to estimate various length-scales in porous media. A 0.267 T permanent magnet at NASA GRC was used for this study. A 2D or 3D spatially-resolved porosity distribution were obtained from the NMR signal strength from each voxel and the spin-lattice relaxation time. A classical spin-warp imaging with Multiple Spin Echos (MSE) was used to evaluate proton density in each voxel. Initial resolution of 256 x 256 was subsequently reduced by averaging neighboring voxels and the porosity convergence was observed. A number of engineered 'space candidate' soils such as Isolite(trademark), Zeoponics(trademark), Turface(trademark), and Profile(trademark) were used. Glass beads in the size range between 50 microns to 2 mm were used as well. Initial results with saturated porous samples have shown a good estimate of the average porosity consistent with the gravimetric porosity measurement results. For Profile(trademark) samples with particle sizes ranging between 0.25 to 1 mm and characteristic interparticle pore size of 100 microns the characteristic Darcy scale was estimated to be about $\delta(\text{sub REV}) = 10 \text{ mm}$. Glass beads porosity show clear convergence toward a definite REV which stays constant throughout homogeneous sample. Additional information is included in the original extended abstract.

Author (revised)

Imaging Techniques; Nuclear Magnetic Resonance; Soils; Particle Size Distribution; Soil Science; Soil Mechanics; Soil Moisture

20050203961 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Regional, Integrated Monitoring System for the Hydrology of the Pan-Arctic Land Mass

Serreze, Mark; Barry, Roger; Nolin, Anne; Armstrong, Richard; Zhang, Ting-Jung; Vorosmarty, Charles; Lammers, Richard; Frolking, Steven; Bromwich, David; McDonald, Kyle; [2005]; 13 pp.; In English

Contract(s)/Grant(s): NAG5-9596; No Copyright; Avail: CASI; [A03](#), Hardcopy

Work under this NASA contract developed a system for monitoring and historical analysis of the major components of the pan-Arctic terrestrial water cycle. It is known as Arctic-RIMS (Regional Integrated Hydrological Monitoring System for the Pan-Arctic Landmass). The system uses products from EOS-era satellites, numerical weather prediction models, station records and other data sets in conjunction with an atmosphere-land surface water budgeting scheme. The intent was to compile operational (at 1-2 month time lags) gridded fields of precipitation (P), evapotranspiration (ET), P-ET, soil moisture, soil freeze/thaw state, active layer thickness, snow extent and its water equivalent, soil water storage, runoff and simulated

discharge along with estimates of non-closure in the water budget. Using ‘baseline’ water budgeting schemes in conjunction with atmospheric reanalyses and pre-EOS satellite data, water budget fields were compiled to provide historical time series. The goals as outlined in the original proposal can be summarized as follows: 1) Use EOS data to compile hydrologic products for the pan-Arctic terrestrial regions including snowcover/snow water equivalent (SSM/A MODIS, AMSR) and near-surface freeze/thaw dynamics (Sea Winds on QuikSCAT and ADEOS I4 SSMI and AMSR). 2) Implement Arctic-RIMS to use EOS data streams, allied fields and hydrologic models to produce allied outputs that fully characterize pan-Arctic terrestrial and aerological water budgets. 3) Compile hydrologically-based historical products providing a long-term baseline of spatial and temporal variability in the water cycle.

Derived from text

Hydrology Models; Arctic Regions; Water Runoff; Numerical Weather Forecasting

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20050199481 NASA Glenn Research Center, Cleveland, OH, USA

Motor Control of Two Flywheels Enabling Combined Attitude Control and Bus Regulation

Kenny, Barbara H.; April 21, 2004; 24 pp.; In English; Space Power Workshop, 20-22 Apr. 2004, Manhattan Beach, CA, USA
Contract(s)/Grant(s): WBS 22-319-20-M1

Report No.(s): E-14800; No Copyright; Avail: CASI; [A03](#), Hardcopy

This presentation discussed the flywheel technology development work that is ongoing at NASA GRC with a particular emphasis on the flywheel system control. The ‘field orientation’ motor/generator control algorithm was discussed and explained. The position-sensorless angle and speed estimation algorithm was presented. The motor current response to a step change in command at low (10 kRPM) and high (60 kRPM) was discussed. The flywheel DC bus regulation control was explained and experimental results presented. Finally, the combined attitude control and energy storage algorithm that controls two flywheels simultaneously was presented. Experimental results were shown that verified the operational capability of the algorithm. shows high speed flywheel energy storage (60,000 RPM) and the successful implementation of an algorithm to simultaneously control both energy storage and a single axis of attitude with two flywheels. Overall, the presentation demonstrated that GRC has an operational facility that

Author

Flywheels; Attitude Control; Energy Storage; Motors; Attitude (Inclination)

20050199676 Tulane Univ., New Orleans, LA, USA

Growth, Surface Characterization, and Reactivity of TIO(sub 2) Anatase Films EPSCOR

Diebold, U.; Dec. 2004; 16 pp.; In English

Report No.(s): DE2005-835107; No Copyright; Avail: Department of Energy Information Bridge

TiO₂ is as promising photocatalyst for environmental degradation of organic compounds and solar energy conversion. Commercial titania is a mixture of rutile and anatase phases, and, for as of yet unknown reasons, anatase is the photocatalytically more active form. In contrast to rutile, atomic-scale information on well-characterized anatase surfaces and their chemical properties was virtually absent at the beginning of this project. We have performed surface science investigations of anatase with the goal to understand, and ultimately control, the surface chemistry underlying its diverse applications. We have of (1) characterized all main crystallographic surface orientations of anatase, namely the (101), (100), (001), and (103) surfaces (2) have investigated the influence of surface imperfections such as defects and steps; (3) have investigated the influence of dopants on epitaxial (001) anatase films; and (3) have investigated the chemical and adsorption and reaction processes of simple molecules (water and methanol) on anatase surfaces. The experiments were performed in collaboration with Pacific Northwest National Laboratory (PNNL) using a variety of complementary surface science techniques. They have lead to a thorough characterization of this model system and have provided a more complete understanding of TiO₂, which could possibly lead to improved efficiency in of photocatalytic applications.

NTIS

Anatase; Reactivity; Titanium Oxides

20050199698 National Renewable Energy Lab., Golden, CO USA

PV Manufacturing R&D Integrated CIS Thin-Film Manufacturing Infrastructure

Tarrant, D. E.; Gay, R. R.; Nov. 2004; 52 pp.; In English

Report No.(s): DE2005-15011691; NREL/SR-520-36982; No Copyright; Avail: Department of Energy Information Bridge

The objective of this subcontract was to continue the advancement of CIS production at Shell Solar Industries through the development of high-throughput CIS absorber formation reactors, implementation of associated safety infrastructure, an XRF measurement system, a bar code scribing system, and Intelligent Processing functions for the CIS production line. The intent was to open up production bottlenecks thereby allowing SSI to exercise the overall process at higher production rates and lay the groundwork for evaluation of near-term and long-term manufacturing scale-up. The goal of the absorber formation reactor subcontract work was to investigate conceptual designs for high-throughput, large area (2x5 ft.) CIS reactors and provide design specifications for the first generation of these reactors. The importance of reactor design to the CIS formation process was demonstrated when first scaling from a baseline process in reactors for substrates to a large area reactor. SSI demonstrated that lower performance for large substrates was due to differences in absorber layer properties that were due to differences in the materials of construction and the physical design of the large reactor. As a result of these studies, a new large area reactor was designed and built that demonstrated circuit plate performance comparable to the performance using small area reactors. For this subcontract work, three tasks were identified to accomplish the absorber formation reactor work: Modeling, Mockup and Vendor Search. The goal of the mockup task was to demonstrate that large area substrates, nominally 2 by 5 ft., could be heated without warping and to begin exploring the achievable thermal uniformity for various reactor and substrate configurations and varied ramp rates. The mockup consisted of a metal simulation of the reactor that was placed in a large industrial furnace. Substrate temperature variations ranged from minimal to significant with increasing substrate load. Warping ranged from minimal to significant with increasing substrate load for higher cool down rates. Repeated mockup runs indicated that a slower cool down does not necessarily avoid warping without improvements in thermal uniformity that could not be implemented in the mockup.

NTIS

Manufacturing; Photovoltaic Conversion; Substrates; Thin Films

20050199713 MVSytems, Inc., Golden, CO, USA

High Efficiency Narrow Gap and Tandem Junction Devices. Final Technical Report

Madan, A.; Mar. 2005; 30 pp.; In English

Report No.(s): DE2005-15011482; No Copyright; Avail: Department of Energy Information Bridge

The work described in this report uses a modified pulsed plasma-enhanced chemical vapor deposition (PECVD) technique that has been successfully developed to fabricate state-of-the-art nc-Si materials and devices. Specifically, we have achieved the following benchmarks: nc SiH device with an efficiency of 8% achieved at a deposition rate of (approx)1 A/s; nc SiH device with an efficiency of 7% achieved at a deposition rate of (approx)5 A/s; large-area technology developed using pulsed PECVD with uniformity of +/-5% over 25 cm x 35 cm; devices have been fabricated in the large-area system (part of Phase 3); an innovative stable four-terminal (4-T) tandem-junction device of h\g 9% fabricated. (Note that the 4-T device was fabricated with existing technology base and with further development can reach stabilized h of 12%); and with improvement in Voc (approx) 650 mV, from the current value of 480 mV can lead to stable 4-T device with h\g16%. Toward this objective, modified pulsed PECVD was developed where layer- by-layer modification of nc-SiH has been achieved. (Note that due to budget cuts at NREL, this project was curtailed by about one year).

NTIS

Solar Cells; Vapor Deposition; Fabrication; Junction Diodes

20050199740 International Solar Electric Technology, Inc., Chatsworth, CA, USA

Lab to Large Scale Transition for Non-Vacuum Thin Film CIGS Solar Cells. Phase II: Annual Technical Report

Kapur, V. K.; Bansal, A.; Asenio, O. I.; Shigeoka, M. K.; Le, P.; Jan. 2005; 36 pp.; In English

Report No.(s): DE2005-15011721; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this subcontract, as part of the R&D Partners category is to: (1) identify the challenges that International Solar Electric Technology, Inc. (ISET) may face in the process of making a 'Lab to Large Scale' transition for its ink-based non-vacuum process in production of thin-film CIGS solar cells and modules, and (2) develop workable solutions for these challenges such that they can readily be implemented in a large-scale processing line for CIGS modules. The primary objective of this research is to streamline ISET's ink-based non-vacuum process for fabricating efficient CIGS modules to lower the cost of module production \h\h \$1.0/watt. To achieve this objective, ISET has focused R&D efforts on investigating topics that directly impact the ultimate cost of processing CIGS modules. These topics of concern include (1) module output, and

therefore, the solar cell and the module efficiency, (2) overall process yield which requires developing a process that offers a very high degree of repeatability for every manufacturing step, and (3) a process approach that maximizes the utilization of the materials used. In accordance with the above, this report will cover activity during Phase II in the investigation of methods for low-cost manufacturing and process development. Specific tasks cover four broad areas: (1) solar cell efficiency, (2) process control, (3) module integration, and (4) enhanced material utilization by reduction of waste stream.

NTIS

Manufacturing; Solar Cells; Thin Films; Vacuum

20050199741 Science Applications International Corp., McLean, VA, USA

Production of Solar Reflective Materials Using a Laboratory Scale Roll Coater. Final Subcontract Report

Smilgys, R.; Jan. 2005; 28 pp.; In English

Report No.(s): DE2005-15011720; NREL/SR-520-37007; No Copyright; Avail: Department of Energy Information Bridge

This report summarizes work performed by Science Applications International Corporation (SAIC) in fulfillment of a contract with the National Renewable Energy Laboratory. The work described here is a continuation of work performed on an earlier contract (YAR-5-15005-01). The goal of the work has been to demonstrate that it is possible to produce a durable low-cost reflector for solar-thermal-electric power systems. The core technology is a technique called ion-beam-assisted physical vapor deposition to produce a silvered reflector with a protective alumina coating. In the previous contract, SAIC optimized the coating process for batch coating. In this contract, we transitioned the coating process from batch coating to roll coating. In the course of the contract, we successfully designed and built a laboratory-scale web handling machine; integrated the machine into the existing SAIC coating chamber; and roll-coated material using an alumina deposition rate as high as 20 nm/s.

NTIS

Coatings; Optical Materials; Phase Change Materials; Roll; Solar Energy Conversion

20050199743 National Renewable Energy Lab., Golden, CO USA

Building America Research Benchmark Definition, Version 3.1, Updated July 14, 2004

Hendron, R.; Jan. 2005; 44 pp.; In English

Report No.(s): DE2005-15011713; NREL/TP-550-36429; No Copyright; Avail: Department of Energy Information Bridge

To track progress toward aggressive multi-year whole-house energy savings goals of 40-70% and onsite power production of up to 30%, the U.S. Department of Energy (DOE) Residential Buildings Program and the National Renewable Energy Laboratory (NREL) developed the Building America Research Benchmark in consultation with the Building America industry teams. The Benchmark is generally consistent with mid-1990s standard practice, as reflected in the Home Energy Rating System (HERS) Technical Guidelines (RESNET 2002), with additional definitions that allow the analyst to evaluate all residential end-uses, an extension of the traditional HERS rating approach that focuses on space conditioning and hot water. A series of user profiles, intended to represent the behavior of a 'standard' set of occupants, was created for use in conjunction with the Benchmark.

NTIS

Buildings; Renewable Energy

20050199751 NASA Glenn Research Center, Cleveland, OH, USA, Department of Energy, USA

Long-Term Creep of a Thin-Walled Inconel 718 Stirling Power-Converter Heater Head Assessed

Bowman, Randy R.; Research and Technology 2002; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Department of Energy and NASA have identified Stirling power converters as candidate power supply systems for long-duration, deep-space science missions. A key element for qualifying the flight hardware is a long-term durability assessment for critical hot section components of the power converter. One such critical component is the power converter heater head. The heater head is a high-temperature pressure vessel that transfers heat to the working gas medium of the converter, which is typically helium. An efficient heater head design is the result of balancing the divergent requirements of thin walls for increased heat transfer versus thick walls to lower the wall stresses and thus improve creep resistance and durability. In the current design, the heater head is fabricated from the Ni-base superalloy Inconel 718 (IN 718, Inco Alloys International, Inc., Huntington, WV). Although IN 718 is a mature alloy system (patented in 1962), there is little long-term ($\sim 50,000$ -hr) creep data available for thin-specimen geometries. Since thin-section properties tend to be inferior to thicker samples, it is necessary to generate creep data using specimens with the same geometry as the actual flight hardware.

Therefore, one facet of the overall durability assessment program involves generating relatively short-term creep data using thin specimens at the design temperature of 649 C (1200 F).

Author

Creep Properties; Heat Resistant Alloys; Stirling Cycle; Thin Walls; Heaters; Heat Transfer; Creep Strength

20050200776 Maritime Academy, Castine, ME USA

Marine Fuel Cell Technology Verification Trainer Program: Operator Curriculum Development

Walk, Steven R.; Libby, Mark; Wade, Laurence V.; Jun. 2004; 170 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0240

Report No.(s): AD-A435181; No Copyright; Avail: CASI; [A08](#), Hardcopy

This report describes the results of tasks completed by Maine Maritime Academy engineering and marine transportation faculty to investigate and develop stationary and ship service fuel cell (SSFC) power plant course work for USA Navy (USN) operators, engineers, and marine integrators, under Office of Naval Research (ONR) grant number N00014-03-1-0240. This work has been performed within a broad multi-year program to confirm the viability of fuel cell-based marine power plants through the operation and monitoring of equipment ashore and at-sea. The report provides detailed lesson boards of comprehensive modules for classroom, laboratory, training simulator, and shipboard training. The modules include suggested topics, content, and supplemental learning materials. Recommended instructor resources and references for module presentations and exercises are provided for each training area. Results of research into emerging learning technologies, in the forms of recommended hardware, software, communications networks, supplemental materials, and simulator specifications are reported with recommendations and reference sources. The report includes a description of the application of operator training module content in support of development of an engineering course in fuel cell power plants at the University of Maine developed under a parallel separate proposal. Sources of information to configure and deliver the operator training curriculum in accord with navy training content guidelines and standards are provided. With the anticipation that up to several years' delay will occur between the time of this report and the maturity of the SSFC technology and its plant operations, suggestions for use of the information in this report and steps toward future curriculum development are provided throughout.

DTIC

Education; Educational Resources; Fuel Cells; Marine Technology; Military Personnel; Training Devices

20050200851 Clemson Univ., SC USA

Energy-Based Design Methodology for Air Vehicle Systems: Aerodynamic Correlation Study

Figliola, Richard S.; Mar. 2005; 11 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0111

Report No.(s): AD-A435403; AFRL-SR-AR-TR-05-0255; No Copyright; Avail: CASI; [A03](#), Hardcopy

This fundamental study served to formulate and predict numerically the performance of a flexible wing in subsonic flow conditions in terms of entropy generation. The developed approach was a joint effort with AFRL personnel in energy-based design. The work represents a new and different approach for detailed drag estimation and vehicle-level utilization of energy. The energy utilization of a wing in a steady, low subsonic, three-dimensional, viscous flow field was modeled. This amounted to estimating the entropy generation due to the lift and the components of drag of the wing. Wing performance was evaluated for three different wing lift distributions on a rectangular, flexible wing. The power required to overcome wing drag is directly proportional to the entropy flux across the wing. In this study, methods for evaluating both the drag and the entropy flux for a wing based the predictions of a three-dimensional, turbulent computational solver were compared to estimates based on experimental airfoil data and lifting line theory predictions. Overall, we show: (1) the mapping of entropy generation clearly details regions of irreversibility in the wing flow field, and (2) under the limited conditions studied, the drag prediction obtained with a far-field entropy method developed here is improved over the traditional wing surface integration approach.

DTIC

Aerodynamics; Computational Fluid Dynamics; Drag

20050200882 Hawaii Univ., Honolulu, HI USA

Hawaii Energy and Environmental Technologies Initiative

Rocheleau, Richard E.; Jun. 2005; 99 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0928

Report No.(s): AD-A435494; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report summarizes work conducted by the Hawaii Natural Energy Institute of the University of Hawaii under the

Hawaii Energy and Environmental Technologies (HEET) Initiative funded through the Office of Naval Research. This initiative focused on critical technology needs associated with the exploration and utilization of seabed methane hydrates and the development and testing of advanced fuel cells and fuel cell systems. The efforts in methane hydrates encompassed six primary components: hydrate thermochemistry and kinetics, hydrate microbiology, subsea power generation, modeling, field studies, and international collaboration. In the fuel cell area, the major accomplishment was the development of the Hawaii Fuel Cell Test Facility to characterize advanced fuel cells and fuel cells systems for Navy applications, specifically for unmanned undersea vehicles.

DTIC

Energy Technology; Flux Density; Fuel Cells; Hydrates; Methane; Surveillance; Underwater Vehicles

20050201018 Naval Postgraduate School, Monterey, CA USA

A Study Examining Photovoltaic (PV) Solar Power as an Alternative for the Rebuilding of the Iraqi Electrical Power Generation Infrastructure

Austin, Curtis; Borja, Ralph; Phillips, Jeffery; Jun. 2005; 187 pp.; In English; Original contains color illustrations
Report No.(s): AD-A435755; No Copyright; Avail: CASI; [A09](#), Hardcopy

This project examined the cost and feasibility of using photovoltaic solar power to assist in the rebuilding of the Iraqi electrical infrastructure. The report covers available solar equipment and technologies coupled with requirements for operation, installation, and maintenance. The report begins with an analysis of the current state of the Iraqi infrastructure, including coalition efforts to begin the reconstruction process, U.S. engineers' actions upon entering Iraq, the increased need for electrical power in Iraq, the costs of insurgent attacks on the electrical system, and security issues that need to be dealt with for the future. There are numerous case studies that demonstrate uses of solar power in regions similar to Iraq. The report presents four such cases: the Sacramento Municipal Utility District in California and schools in Australia, Mexico, and South Africa. The report then identifies potential commercial solar equipment candidates for different installation configurations, including on-grid, off-grid, and hybrid systems; the installation, operation, maintenance, and durability of solar PV systems; solar technology's positive and negative attributes; the use of Radio Frequency Identification (RFID) to prevent sabotage; and emerging technologies. Next, the authors provide test data to illustrate the performance of Photovoltaic Power Conversion (PVPC) technology compared to a conventional solar PV system. The report concludes with a cost comparison for PVPC versus conventional systems, and cost estimates for using solar PV systems in powering a residential home, public service provider, school, and hospital. The appendixes contain information that decision makers may need as part of an operations order, including details on the components of a solar PV system, maintenance, retailers, assemblies, and community applications; Operation Solar Eagle worksheets; and weather data and other data for testing solar PV systems with and without PVPC technology⁷

DTIC

Electric Generators; Electric Power Plants; Installing; Iraq; Maintenance; Photovoltaic Effect; Solar Energy

20050201092 Army Construction Engineering Research Lab., Champaign, IL USA

Process and Energy Optimization Assessment, Rock Island Arsenal, IL

Lin, Mike C.; Zhivov, Alexander M.; Boddu, Veera M.; Osborn, David; Smith, Walter P.; Bjork, Curt; Chimack, Michael J.; Miller, Robert A.; Sep. 2004; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435892; ERDC/CERL-TR-04-17; No Copyright; Avail: Defense Technical Information Center (DTIC)

A Process and Energy-Optimization Assessment (PEOA) was conducted at Rock Island Arsenal, IL, to identify process, energy, and environmental opportunities that could significantly improve the installation's mission readiness and competitive position. The study was targeted at creating a holistic approach to energy optimization in industrial facilities and included measures related to industrial processes, building envelope, and energy and mechanical systems. A team of researchers and expert consultants performed a Phase-1 PEOA during the week of 21 June 2004. The scope of the PEOA included plating, painting, machining, welding, foundry, and heat treatment production processes, and also an assessment of the building envelope, ventilation, compressed air systems, and steam boilers. The study identified 36 energy conservation measures (ECMs); 23 of these were quantified economically. Implementing the 23 ECMs will reduce RIA energy and operating costs by approximately \$1.75M, will yield an average simple payback of 1.7 years (21 months), and will improve the work environment.

DTIC

Energy Conservation; Energy Consumption; Rocks

20050201601 Pennsylvania State Univ., University Park, PA, USA

Research in Hydrogen Passivation of Defects and Impurities in Silicon

Ashok, S.; Dec. 2004; 16 pp.; In English

Report No.(s): DE2005-15011711; NREL/SR-520-37181; No Copyright; Avail: Department of Energy Information Bridge

This subcontract report describes hydrogenating Si samples by different methods such as low-energy implantation, electron cyclotron resonance (ECR) plasma, and thermal diffusion. The samples were provided through NREL. The experimental work, carried out at Penn State, involved the study of hydrogen interaction with defects, trapping, migration, and formation of complexes. The principal vehicle for the latter study was ion implantation, and the intent to understand mechanisms of defect passivation and activation by hydrogen. NREL implemented a study of hydrogen passivation of impurities and defects in silicon solar cells. The work included theoretical and experimental components performed at different universities. The theoretical studies consisted of the calculation of the structure and parameters related to hydrogen diffusion and interactions of hydrogen with transition-metal impurities in silicon. Experimental studies involved measurements of hydrogen and hydrogen-impurity complexes, and diffusion properties of various species of hydrogen in Si. The experimental work at Penn State included introduction of hydrogen in a variety of PV Si by ECR plasma, low-energy ion implantation, and thermal diffusion.

NTIS

Defects; Hydrogen; Impurities; Passivity; Silicon; Solar Cells

20050201607 Midtronics, Inc., Willowbrook, IL USA

Adapting Conductance Technology for Military Application

Swanson, Randy R.; Jun. 2005; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W15P7T-04-C-P013

Report No.(s): AD-A435425; APD-IM-152; No Copyright; Avail: Defense Technical Information Center (DTIC)

In military vehicles, many mission-critical systems rely heavily on battery power for operation. Should the batteries fail or become deeply discharged, the mission-critical systems will fail, and the batteries will not be able to start the vehicle engine, leaving the vehicle and its occupants stranded and vulnerable. Without knowing the status of the batteries, the commander is limited in his ability to keep soldiers and equipment out of harm's way. Already today, without accurate diagnostic and testing systems, battery replacement costs are a major military expense. Many batteries are replaced prematurely, while others are replaced after they have already failed and the costs of service, jump-start and replacement have already been incurred. Testing methods and equipment utilized by and available to the military today have not been successful at accurately determining failed batteries from those that are discharged and recoverable. By providing conductance-based testing and charging equipment, and outfitting vehicles with battery monitoring systems, the readiness of vehicles would be dramatically increased while reducing unnecessary replacement expenses.

DTIC

Battery Chargers; Lead Acid Batteries; Microinstrumentation; Military Technology; Sensors; Technology Utilization; Transconductance

20050201635 Army Construction Engineering Research Lab., Champaign, IL USA

Central Heating and Power Plant Conversion at Fort Wainwright, AK: Heating Only with Backup Generation Option

Vavrin, John L.; Potts, Noel L.; Westerman, John; Lorand, Robert; Schmidt, Charles; Heintel, Raymond; Kemme, Michael P.; Nov. 2004; 110 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-MIPR

Report No.(s): AD-A435911; ERDC/CERL-TR-04-23; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Fort Wainwright military community has a critical need to establish its power and heating requirements to successfully complete a series of planned capital improvements. The CHPP upgrade coincides with an expansion of FWA's mission within the next 5 years.

DTIC

Heat; Heating

20050201670 California Univ., Los Angeles, CA USA

Self-Activated Micro Direct-Methanol Fuel Cell (muDMFC) at Near Room Temperature

Zhong, Xiaolin; Ho, Chih-Ming; Kim, Chang-Jin; Zhang, Xiang; Wang, Chao-Yang; Jun. 2005; 53 pp.; In English

Contract(s)/Grant(s): DAAH01-1-R001

Report No.(s): AD-A435876; No Copyright; Avail: CASI; [A04](#), Hardcopy

This research project was focused on the development and testing of Micro Direct-Methanol Fuel Cells (Micro DMFC). A Si-based Micro DMFC was developed and its electrochemical characteristics studied. The peak power density reached 50 mW/sq cm at 60 deg C. A new MEA design was successfully developed to mitigate MeOH crossover without requiring novel membranes. A Micro DMFC was also fabricated by using photochemically etched stainless steel bipolar plates and the performance was improved to achieve a maximum power density of 100 mW/sq cm at 60 deg C and atmospheric pressure. Water crossover through the membrane was found to be a critical issue to limit direct use of high concentration fuel. A solution using the capillary pressure to push water back from the cathode to anode and a thin membrane such as Nafion 112 has been successfully developed. The net water crossover through the membrane was reduced by a factor of five. This paves the way to directly use concentrated fuel on the anode. An 8-cell air-breathing DMFC stack was developed and demonstrated. Cathode flooding was totally avoided using our newly developed water management strategy. It was found that O₂ transport in air-breathing operation is sufficient. Results also demonstrated that it is feasible to finally use pure methanol in a completely passive DMFC. Experimental results proved the degassing ability of sandwiched membrane breather to separate CO₂ from aqueous methanol fuel stream in the Micro DMFC, and we determined that the bubble breathing feature can take a more active role in the microfluidic management of the whole system. Since the bubble breathing rate can be much faster than condensing rate of vapor bubble, which led to inefficiency of most reported micro bubble pumps, our degassing technique with hydrophobic porous membrane opened a great opportunity for a self-pumping mechanism to circulate the fuel inside Micro DMFC.

DTIC

Electrochemistry; Fuel Cells; Methyl Alcohol; Room Temperature

20050201988 Department of Energy, Washington, DC, USA

Program and Abstracts: DOE Solar Program Review Meeting 2004, 25--28 October 2004, Denver, Colorado

January 2005; 112 pp.; In English

Report No.(s): DE2005-15011689; No Copyright; Avail: Department of Energy Information Bridge

This booklet contains the agenda and abstracts for the 2004 U.S. DOE Solar Energy Technologies Program Review Meeting. The meeting was held in Denver, Colorado, October 25-28, 2004. More than 240 abstracts are contained in this publication. Topic areas for the research papers include laboratory research, program management, policy analysis, and deployment of solar technologies.

NTIS

Solar Energy; Photovoltaic Conversion; Water Heating

20050203694 NASA Glenn Research Center, Cleveland, OH, USA

Light Weight Design Nickel-Alkaline Cells Using Fiber Electrodes

Pickett, David F.; Willis, Bob; Britton, Doris; Saelens, Johan; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Using fiber electrode technology, currently produced by Bekaert Corporation (Bekaert), Electro Energy, Inc., (EEI) Mobile Energy Products Group (formerly, Eagle-Picher Technologies, LLC., Power Systems Department) in Colorado Springs, CO has demonstrated that it is feasible to manufacture flight weight nickel-hydrogen cells having about twice the specific energy (80 vs. 40 watt-hr/kg) as state-of-the-art nickel-hydrogen cells that are flown on geosynchronous communications satellites. Although lithium-ion battery technology has made large in-roads to replace the nickel-alkaline technology (nickel-cadmium, nickel-metal hydride), the technology offered here competes with lithium-ion weight and offers alternatives not present in the lithium-ion chemistry such as ability to undergo continuous overcharge, reversal on discharge and sustain rate capability sufficient to start automotive and aircraft engines at subzero temperatures. In development to date seven 50 ampere-hour nickel-hydrogen have been constructed, acceptance tested and briefly tested in a low earth orbit (LEO) cycle regime. The effort was jointly funded by Electro Energy, Inc. and NASA Glenn Research Center, Cleveland, OH. Five of the seven cells have been shipped to NASA GRC for further cycle testing. Two of the cells experienced failure due to internal short circuits during initial cycle testing at EEL Destructive Physical Analysis (DPA) of one of the cells has shown the failure mode to be due to inadequate hydrogen catalyst electrodes that were not capacity balanced with the higher energy density nickel oxide electrodes. In the investigators opinion, rebuild of the cells using proper electrode balance would result in cells that could sustain over 30,000 cycles at moderate depths-of-discharge in a LEO regime or endure over 20 years of geosynchronous orbit (GEO) cycling while realizing a two-fold increase in specific energy for the battery or a 1.1 kg weight savings per 50 ampere-hour cell. Additional information is included in the original extended abstract.

Author (revised)

Alkaline Batteries; Nickel Hydrogen Batteries; Electrodes; Fibers

20050203699 NASA Glenn Research Center, Cleveland, OH, USA

Electrochemical Characterization of Carbon Nanotubes for Fuel Cell MEA's

Panagaris, Jael; Loyselle, Patricia; [2004]; 1 pp.; In English; IECES Conference, 16-19 Sep. 2004, RI, USA; No Copyright; Avail: Other Sources; Abstract Only

Single-walled and multi-walled carbon nanotubes from different sources have been evaluated before and after sonication to identify structural differences and evaluate electrochemical performance. Raman spectral analysis and cyclic voltammetry in situ with QCM were the principle means of evaluating the tubes. The raman data indicates that sonication in toluene modifies the structural properties of the nanotubes. Sonication also affects the electrochemical performance of single-walled nanotubes and the multi-walled tubes differently. The characterization of different types of carbon nanotubes leads up to identifying a potential candidate for incorporating carbon nanotubes for fuel cell MEA structures.

Author

Carbon Nanotubes; Electrochemistry; Fuel Cells; Membranes; Electrodes

20050203755 Hughes Space and Communications Co., El Segundo, CA, USA

In-Orbit Performance of Hughes HS601HP Dual Junction GaInP₂/GaAs/Ge Solar Arrays

Gelb, Steven W.; Fodor, Jay S.; Powe, Joseph S.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 74-82; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Hughes Space and Communication Company's body-stabilized HS601 HP communications satellites represent the first commercial spacecraft to utilize dual junction GaInP₂/GaAs/Ge solar cells as their primary power source. The in-orbit electrical performance of four of these spacecraft has been monitored and compared to ground-based predictions. The predictions employ the as-built solar array configuration and electrical performance, the actual in-orbit radiation environment, and additional predicted environmental factors. Hughes' manufacturing and prediction methodology has led to agreement between the average telemetered and predicted power of plus or minus two percent for these spacecraft.

Author

Gallium Arsenides; Solar Arrays; Germanium; Gallium Phosphides; Indium Phosphides; Communication Satellites; Performance Prediction; Commercial Spacecraft

20050203758 Naval Research Lab., Washington, DC, USA

Displacement Damage Dose Analysis of Neutron Irradiated Single and Dual Junction GaAs-Based Solar Cells

Walters, R. J.; Summers, G. P.; Messenger, S. R.; Burke, E. A.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 39-43; In English; See also 20050203753; No Copyright; Avail: CASI; A01, Hardcopy

The advantages of the Naval Research Laboratory (NRL) model in which the radiation response of space solar cells in analyzed in terms of displacement damage dose ($D_{sub d}$) are now well known. When analyzed in terms of $D_{sub d}$, degradation data due to irradiation by different particles at different energies can be described by a single, characteristic curve. The characteristic curve can then be used to describe the cell response to irradiation by any particle, or by a spectrum of particle energies, for which the NIEL is known, thereby simplifying predictions of on-orbit performance. Also, since the characteristic curve can typically be determined from only one or two sets of measurements, the NRL model greatly reduces the data required to characterize the radiation response of a new cell technology. Application of the NRL model has been described for several solar cell technologies in the natural space radiation environment, i.e., for proton and electron irradiations. However, there is little information in the literature about the response of cells in neutron irradiation. In this paper, the response of single-junction (SJ) GaAs/Ge and dual-junction (DJ) InGaP₂/GaAs/Ge solar cells to irradiation by a spectrum of neutrons produced by a fast burst reactor is presented. The solar cell degradation is compared to that measured under 1 Me electron and 10 MeV proton irradiation. It is then shown how the neutron and natural environment data can be directly correlated the in terms of $D_{sub d}$.

Author

Damage Assessment; Displacement; Gallium Arsenides; Neutron Irradiation; Germanium; Solar Cells; Radiation Dosage

20050203765 Spectrolab, Inc., Sylmar, CA, USA

Recent Progress in the Development of High-Efficiency Ga(sub 0.5)In(sub 0.5)P/GaAs/Ge Dual-and Triple-Junction Solar Cells

Karam, Nasser; King, Richard R.; Krut, Dinitri D.; Ermer, James H.; Haddad, Moran; Cotal, Hector; Eldredge, Jack W.; 16th

Space Photovoltaic Research and Technology Conference; May 2005, pp. 109; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

This paper describes recent progress in the development and characterization of high-efficiency, radiation-resistant Ga(sub 0.5)In(sub 0.5)P/GaAs/Ge dual-junction (DJ) and triple-junction (TJ) solar cells developed under the Manufacturing Technology phase II program. DJ cells have rapidly transitioned from the laboratory to full-scale production at Spectrolab in 1997. Advances in next-generation triple-junction Ga(sub 0.5)In(sub 0.5)P/GaAs/Ge cells with an active Ge component cell are discussed, giving efficiencies up to 26.7% (21.65 sq cm area), AM0, at 28 C. Over 1580 triple-junction solar cells have been fabricated during the cell development stages of this program with an average efficiency of 24.7% AM0, at 28 C. Final-to-initial power ratios P/P(sub 0) of 0.83 were measured for these n-on-p DJ and TJ cells after irradiation with 10(exp 15) 1-MeV electrons/sq cm. Dual- and triple-junction Ga(sub 0.5)In(sub 0.5)P/GaAs/Ge cells are compared to competing space photovoltaic technologies, and found to offer 60-75% more end-of-life power than high-efficiency Si cells at a nominal array temperature of 60 C. We will report on the recent advances in the multi-junction solar cell technology at Spectrolab.

Author

Solar Cells; Gallium Arsenides; Gallium Phosphides; Indium; Germanium; Semiconductor Junctions

20050203768 Aerospace Corp., Los Angeles, CA, USA

Development of a Thin Film Amorphous Silicon Space Solar Cell for the PowerSphere Concept

Simburger, Edward J.; Scott, David; Smith, Dennis; Gilmore, David; Meshishnek, Mike; Abraham, Meg; Jeffery, Frank R.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 143-148; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Aerospace Corporation has independently developed conceptual designs for microsatellites and nanosatellites. This development of microsatellites and nanosatellites for low earth orbits requires the collection of sufficient power for onboard instruments with a low weight, low volume spacecraft. Because the overall surface area of a microsatellite or nanosatellite is small, body-mounted solar cells are incapable of providing enough power. Deployment of traditional, rigid, solar arrays necessitates larger satellite volumes and weights, and also requires extra apparatus needed for pointing. One potential solution to this 'power choke' problem is the deployment of a large, spherical, inflatable power system. This power system, termed the 'PowerSphere', would offer a high collection area, low weight, and low stowage volume, and eliminate the need for a pointing mechanism. Development of the PowerSphere concept in FY 99 focused on the design and fabrication of Amorphous Silicon Solar Cells that would meet the space thermal requirements identified in work completed in FY 98. This effort was carried out in cooperation with Iowa. Thin Films where minor modifications to the terrestrial product line were identified and implemented in producing a first generation thin film amorphous silicon solar cell deposited on a polyimide substrate for space applications. The up to date results of this effort will be reported on in this paper.

Author

Amorphous Silicon; Solar Cells; Thin Films; Fabrication

20050203769 Toyota Motor Co., Nagoya, Japan

Recent Space Photovoltaic Research and Development in Japan

Yamaguchi, Masafumi; Matsuda, Sumio; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 135-142; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

This paper reviews recent space solar cell R&D activities in Japan. R&D of super-high efficiency multi-junction cells are carried out in the New Sunshine Project. Up to now, the InGaP/GaAs 2-junction cells fabricated on Ge substrates have reached 30.9% at AM1.5, and high-efficiency of 26.9% at AM0 has also been attained with the InGaP/GaAs 2-junction cells on GaAs substrates. As by-product of high-efficiency cells the same cells are thought to have the potential for space applications. By using a small satellite MDS-1 with a solar cell monitor board, Japanese solar cells developed for terrestrial use such as poly-Si, a-Si/n-Si hetero-junction, CuInGaSe2 and InGaP/GaAs 2-junction cells will be evaluated in space. For this end, such cells have been evaluated on the ground. In the field of Si space solar cells, the accident of the Engineering Test Satellite-VI has provided an opportunity to clarify the mechanism on the anomalous degradation of Si space cells under high fluence irradiation is explained by carrier removal effect and type conversion caused by radiation-induced defects in p-type base layer. According to the DLTS analysis, carrier removal and type conversion in p-Si are found to be caused by generation of E(sub v)+0.36eV (C(sub i)-O(sub j)), E(sub v)+0.18eV (V-V) and E(sub c)-0.18eV (B(sub i)-O(sub J)). A new project to improve the end-of-life efficiency of Si space cells has also been started.

Author

Japan; Research and Development; Solar Cells; Fabrication

20050203770 NASA Marshall Space Flight Center, Huntsville, AL, USA

Combined Silicon and Gallium Arsenide Solar Cell UV Testing

Willowby, Douglas; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 53; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

The near and long-term effect of UV on silicon solar cells is relatively understood. In an effort to learn more about the effects of UV radiation on the performance of GaAs/Ge solar cells, silicon and gallium arsenide on germanium (GaAs/Ge) solar cells were placed in a vacuum chamber and irradiated with ultraviolet light by a Spectrolab XT 10 solar simulator. Seventeen GaAs/Ge and 8 silicon solar cells were mounted on an 8 inch copper block. By having all the cells on the same test plate we were able to do direct comparison of silicon and GaAs/Ge solar cell degradation. The test article was attached to a cold plate in the vacuum chamber to maintain the cells at 25 degrees Celsius. A silicon solar cell standard was used to measure beam uniformity and any degradation of the ST-10 beam. The solar cell coverings tested included cells with AR-0213 coverglass, fused silica coverglass, BRR-0213 coverglass and cells without coverglass. Of interest in the test is the BRR-0213 coverglass material manufactured by OCLI. It has an added Infrared rejection coating to help reduce the solar cell operating temperature. This coverglass is relatively new and of interest to several current and future programs at Marshall. Due to moves of the laboratory equipment and location only 350 hours of UV degradation have been completed. During this testing a significant leveling off in the rate of degradation was reached. Data from the test and comparisons of the UV effect of the bare cells and cells with coverglass material will be presented.

Author

Gallium Arsenides; Silicon; Solar Cells; Ultraviolet Radiation; Germanium

20050203772 NASA Glenn Research Center, Cleveland, OH, USA

Silicon Carbide Radioisotope Batteries

Rybicki, George C.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 199-203; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

The substantial radiation resistance and large bandgap of SiC semiconductor materials makes them an attractive candidate for application in a high efficiency, long life radioisotope battery. To evaluate their potential in this application, simulated batteries were constructed using SiC diodes and the alpha particle emitter Americium Am-241 or the beta particle emitter Promethium Pm-147. The Am-241 based battery showed high initial power output and an initial conversion efficiency of approximately 16%, but the power output decayed 52% in 500 hours due to radiation damage. In contrast the Pm-147 based battery showed a similar power output level and an initial conversion efficiency of approximately 0.6%, but no degradation was observed in 500 hours. However, the Pm-147 battery required approximately 1000 times the particle fluence as the Am-242 battery to achieve a similar power output. The advantages and disadvantages of each type of battery and suggestions for future improvements will be discussed.

Author

Silicon Carbides; Radioisotope Batteries; Semiconductors (Materials); Photovoltaic Conversion

20050203773 Ohio State Univ., Columbus, OH, USA

High Quality GaAs Growth by MBE on Si Using GeSi Buffers and Prospects for Space Photovoltaics

Carlin, J. A.; Ringel, S. A.; Fitzgerald, E. A.; Bulsara, M.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 204-210; In English; See also 20050203753; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-1461; No Copyright; Avail: CASI; [A02](#), Hardcopy

III-V solar cells on Si substrates are of interest for space photovoltaics since this would combine high performance space cells with a strong, lightweight and inexpensive substrate. However, the primary obstacles blocking III-V/Si cells from achieving high performance to date have been fundamental materials incompatibilities, namely the 4% lattice mismatch between GaAs and Si, and the large mismatch in thermal expansion coefficient. In this paper, we report on the molecular beam epitaxial (MBE) growth and properties of GaAs layers and single junction GaAs cells on Si wafers which utilize compositionally graded GeSi Intermediate buffers grown by ultra-high vacuum chemical vapor deposition (UHVCVD) to mitigate the large lattice mismatch between GaAs and Si. Ga As cell structures were found to incorporate a threading dislocation density of $0.9-1.5 \times 10^6$ per square centimeter, identical to the underlying relaxed Ge cap of the graded buffer, via a combination of transmission electron microscopy, electron beam induced current, and etch pit density measurements. AlGaAs/GaAs double heterostructures were grown on the GeSi/Si substrates for time-resolved photoluminescence measurements, which revealed a bulk GaAs minority carrier lifetime in excess of 10 ns, the highest lifetime ever reported for GaAs on Si. A series of growth were performed to assess the impact of a GaAs buffer to a thickness of only 0.1 micrometer. Secondary ion mass spectroscopy studies revealed that there is negligible cross diffusion of Ga, As

and Ge at the III-V/Ge interface, identical to our earlier findings for GaAs grown on Ge wafers using MBE. This indicates that there is no need for a buffer to 'bury' regions of high autodoping, and that either pn or np configuration cells are easily accommodated by these substrates. Preliminary diodes and single junction AlGaAs heteroface cells were grown and fabricated on the Ge/GeSi/Si substrates for the first time. Diodes fabricated on GaAs, Ge and Ge/GeSi/Si substrate show nearly identical I-V characteristics in both forward and reverse bias regions. External quantum efficiencies of AlGaAs/GaAs cell structures grown on Ge/GeSi/Si and Ge substrates demonstrated nearly identical photoresponse, which indicates that high lifetimes, diffusion lengths and efficient minority carrier collection is maintained after complete cell processing.

Author

Molecular Beam Epitaxy; Photovoltaic Conversion; Gallium Arsenides; Silicon; Germanium; Buffers (Chemistry); Fabrication

20050203775 State Univ. of New York, Buffalo, NY, USA

Towards a Thin Film Silicon Heterojunction Solar Cell

Song, Young; Gulians, Elena; Anderson, Wayne; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 149-157; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

This project utilizes an a-Si:H/polycrystalline or microcrystalline Si concept as a low-cost, light-weight means of achieving photovoltaic power conversion. The base region is produced by a metal-induced growth (MIG) in which Si is sputtered onto a foreign substrate, first coated with 25 nm of Ni. Films thus far have reasonable electrical properties. The emitter region is deposited by electron cyclotron resonance CVD with the substrate illuminated during deposition to improve the properties of the a-Si:H. Theoretically, this design should achieve an efficiency of 16-18%, depending on the features.

Author

Heterojunction Devices; Solar Cells; Thin Films; Photovoltaic Conversion; Fabrication

20050203781 NASA Glenn Research Center, Cleveland, OH, USA

Use of Displacement Damage Dose in an Engineering Model of GaAs Solar Cell Radiation Damage

Morton, T. L.; Chock, R.; Long, K. J.; Bailey, S.; Messenger, S. R.; Walters, R. J.; Summers, G. P.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 35-38; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

Current methods for calculating damage to solar cells are well documented in the GaAs Solar Cell Radiation Handbook (JPL 96-9). An alternative, the displacement damage dose (D(sub d)) method, has been developed by Summers, et al. This method is currently being implemented in the SAVANT computer program.

Derived from text

Displacement; Radiation Damage; Solar Cells; Radiation Dosage; Models; Engineering

20050203783 NASA Glenn Research Center, Cleveland, OH, USA

n/p/n Tunnel Junction InGaAs Monolithic Interconnected Module (MIM)

Wilt, David M.; Murray, Christopher S.; Fatemi, Navid S.; Weizer, Victor; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 211-219; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Monolithic Interconnected Module (MIM), originally introduced at the First NREL thermophotovoltaic (TPV) conference, consists of low-bandgap indium gallium arsenide (InGaAs) photovoltaic devices, series interconnected on a common semi-insulating indium phosphide (InP) substrate. An infrared reflector is deposited on the back surface of the substrate to reflect photons, which were not absorbed in the first pass through the structure. The single largest optical loss in the current device occurs in the heavily doped p-type emitter. A new MIM design (pat.pend.) has been developed which flips the polarity of the conventional MIM cell (i.e., n/p rather than p/n), eliminating the need for the high conductivity p-type emitter. The p-type base of the cell is connected to the n-type lateral conduction layer through a thin InGaAs tunnel junction. 0.58 eV and 0.74 eV InGaAs devices have demonstrated reflectances above 90% for wavelengths beyond the bandgap (greater than 95% for unprocessed structures). Electrical measurements indicate minimal voltage drops across the tunnel junction (less than mV/junction under 1200K-blackbody illumination) and fill factors that are above 70% at current densities (J(sub sc)) above 8 Angstroms per square centimeters for the 0.74eV devices.

Author

Indium Gallium Arsenides; N-P-N Junctions; Joining; Thermophotovoltaic Conversion; Integrated Circuits

20050203784 Sandia National Labs., Albuquerque, NM, USA

Antireflection Coating Design For Multi-Junction, Series Interconnected Solar Cells

Aiken, Daniel J.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 129-134; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

Analytical expressions used to optimize AR coatings for single junction solar cells are extended for use in monolithic, series interconnected multi-junction solar cell AR coating design. The result is an analytical expression which relates the solar cell performance (through $J(\text{sub sc})$) directly to the AR coating design through the device reflectance. It is also illustrated how AR coating design be used to provide an additional degree of freedom for current matching multi-junction devices.

Author

Antireflection Coatings; Solar Cells; Fabrication; Optimization

20050203785 Optical Coating Lab., Inc., Santa Rosa, CA, USA

SolaMax(Trademark)Microsheet Solar Cell Coverglass: Space Radiation Qualification Test Results

Cooke, Janeen A.; Larro, Mike; Madigan, Mark; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 44-52; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

For more than 15 years, coated ceria-doped borosilicate microsheet solar cell coverglass, like Corning 0213, has provided maximum power output when bonded to space solar cells. However, during the past several years, space photovoltaic manufacturers have made numerous improvements in cell designs to significantly increase efficiency. Such improvements include front-surface etching of silicon solar cells and adding multiple junctions to III-V solar cells. The effect of these changes has been the broadening of the bandwidth response of the improved cells, to the point where the coverglass limits the solar cell response, particularly in the UV region of the spectrum. To solve this inefficiency in existing solar cell coverglass, OCLI has developed SolaMax(TM), a new generation of high performance microsheet. A standard suite of simulated space radiation tests of SolaMax(TM) microsheet glass has been completed, and herein, we present the BOL/EOL results. In-process data analysis indicates that SolaMax(TM) undergoes minimal changes in performance after exposure to space radiation environments. The space effects test matrix included 300 equivalent sun days in vacuum UV, high-energy electron radiation of 1.0 MeV to a fluence of $1.0\text{E}+15$ per square centimeter, high-energy proton radiation at 0.5 MeV to $5.0\text{E}+14$ per square centimeter, and low-energy proton radiation at 30 keV to $7.4\text{E}+15$ per square centimeter. Results of standard manufacturing qualification tests are also described.

Author

Extraterrestrial Radiation; Borosilicate Glass; Solar Cells; Radiation Effects; Manufacturing

20050203796 NASA Glenn Research Center, Cleveland, OH, USA

Thin-Film Solar Cells on Polymer Substrates for Space Power

Hepps, A. F.; McNatt, Jeremiah; Morel, D. L.; Ferckides, C. S.; Jin, M. H.; Orbey, N.; Cushman, M.; Birkmire, R. W.; Shafarman, W. N.; Newton, R., et al.; [2004]; 1 pp.; In English; International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: Other Sources; Abstract Only

Photovoltaic arrays have played a key role in power generation in space. The current technology will continue to evolve but is limited in the important mass specific power metric (MSP or power/weight ratio) because it is based on bulk crystal technology. Solar cells based on thin-film materials offer the promise of much higher MSP and much lower cost. However, for many space applications, a 20% or greater AM0 efficiency (η) may be required. The leading thin-film materials, amorphous Si, CuInSe, and CdTe have seen significant advances in efficiency over the last decade but will not achieve the required efficiency in the near future. Several new technologies are herein described to maximize both device η and MSP. We will discuss these technologies in the context of space exploration and commercialization. One novel approach involves the use of very lightweight polyimide substrates. We describe efforts to enable this advance including materials processing and device fabrication and characterization. Another approach involves stacking two cells on top of each other. These tandem devices more effectively utilize solar radiation by passing through non-absorbed longer wavelength light to a narrow-bandgap bottom cell material. Modeling of current devices in tandem format indicates that AM0 efficiencies near 20% can be achieved with potential for 25% in the near future. Several important technical issues need to be resolved to realize the benefits of lightweight technologies for solar arrays, such as: monolithic interconnects, lightweight array structures, and new ultra-light support and deployment mechanisms. Recent advances will be stressed.

Author

Solar Cells; Substrates; Thin Films; Polymers; Fabrication; Electric Generators

20050203866 NASA Glenn Research Center, Cleveland, OH, USA

Unitized Regenerative Fuel Cell System Dryer-Humidifier Analytical Model Development

Burke, Kenneth A.; Jakupca, Ian; December 12, 2003; 1 pp.; In English; 2nd International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): 319-20-J1; No Copyright; Avail: Other Sources; Abstract Only

A Unitized Regenerative Fuel Cell (URFC) Energy Storage System is being developed at the NASA Glenn Research Center. This URFC system is unique in that it uses regenerative gas dryers/humidifiers that are mounted on the surface of the gas storage tanks that act as the radiators for thermal control of the URFC system. As the gas storage tanks cool down during URFC charging the regenerative gas dryers/humidifiers dry the hydrogen and oxygen gases produced by electrolysis. As the gas storage tanks heat up during URFC discharging, the regenerative gas dryers/humidifiers humidify the hydrogen and oxygen gases used by fuel cell. An analytical model was developed to simulate the URFC system's regenerative gas dryers/humidifiers. The model is in the form of an EXCEL® worksheet that allows the investigation of the regenerative gas dryers/humidifier performance as a function of time and position within the regenerative gas dryers/humidifiers, as well as other key system variables. Finite Element Analysis (FEA) modeling of the regenerative gas dryers/humidifier and gas storage tank wall was also done to analyze spatial temperature distribution within the regenerative gas dryers/humidifiers and the localized tank wall. Test results obtained from the testing of the regenerative gas dryers/humidifiers in a thermal vacuum environment were used to corroborate the analyses.

Author

Regenerative Fuel Cells; Mathematical Models; Drying Apparatus; Humidity

20050203869 NASA Glenn Research Center, Cleveland, OH, USA

Preparation of Proton Exchange Membranes and Lithium Batteries from Melamine-containing Ormosils

Tigelaar, Dean M.; Kinder, James D.; Meador, Mary Ann; Waldecker, James; Bennett, William R.; [2004]; 1 pp.; In English; 2004 National Meeting of the Electrochemical Society, 3-8 Oct. 2004, Honolulu, HI, USA

Contract(s)/Grant(s): NCC3-1089; 22-708-28-05; No Copyright; Avail: CASI; A01, Hardcopy

Our laboratory has recently reported a series of rodcoil polymers for lithium batteries that display dimensionally stable films with good ionic conductivity. The rod segments consist of rigid linear and branched polyimides and the coil segments are polyethylene oxides (PEO). It has been proposed that good mechanical and transport properties are due to phase separation between the rod and coil segments. It was also observed that increased branching and molecular weight lead to increased conductivity. The following study was undertaken to assess the effects of phase separation in polyalkylene oxides connected by melamine linkages. Melamine was chosen as the linking unit because it provides a branching site, cation binding sites to help ionic transport between polymer chains, and the opportunity for self assembly through hydrogen bonding. Polymers were made by the reaction of cyanuric chloride with a series of amine-terminated alkylene oxides. A linear polymer was first made, followed by reaction of the third site on cyanuric chloride with varying ratios of monofunctional Jeffamine and (3-aminopropyl)triethoxysilane. The lithium trifluoromethane sulfonamide-doped polymers are then crosslinked through a sol-gel process to form free-standing films. Initial results have shown mechanically strong films with lithium conductivities on the order of $2 \times 10(\exp -5)$ S/cm at ambient temperature. In a separate study, organically modified silanes (Ormosils) that contain sulfonic acid derivatized melamines have been incorporated into proton exchange membranes. The membranes are made by reaction of the primary amine groups of various ratios of melamine derivative and difunctional Jeffamine (MW = 2000) with the epoxide group of (3-Glycidyloxypropyl)trimethoxysilane. The films were then cross-linked through a sol-gel process. Resulting sulfuric acid doped films are strong, flexible, and have proton conductivities on the order of $2 \times 10(\exp -2)$ S/cm (120 C, 25% relative humidity). Our best results have been observed when films contain 60% PEO and 40% sulfonated melamine.

Author (revised)

Lithium Batteries; Membranes; Ion Exchanging; Protons; Melamine; Silanes

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20050199664 Gas Technology Inst., Des Plaines, IL, USA

LNG Safety Research: FEM3A Model Development. Quarterly Report

Havens, J.; Salehi, I. A.; Feb. 21, 2005; 16 pp.; In English

Report No.(s): DE2005-838123; No Copyright; Avail: Department of Energy Information Bridge

This quarterly report for DE-FG26-04NT42030 covers a period from October 1, 2004 to December 31, 2004. On December 9, 2004 a meeting was held in Morgantown to rescope the LNG safety modeling project such that the work would complement the DOE's efforts relative to the development of the intended LNG-Fluent model. It was noted and discussed at the December 9th meeting that the fundamental research being performed on surface to cloud heat transfer and low wind speed issues will be relevant to the development of the DOE LNG/Fluent Model. In general, it was decided that all research to be performed from December 9th through the remainder of the contract is to be focused on the development of the DOE LNG/Fluent model. In addition, all GTI activities for dissemination and transfer of FEM3A will cease and dissemination activities will focus on the new DOE LNG/Fluent model. The proposed new scope of work is presented in section 4 of this report. The work reported in the present document relates to the original scope of work which was in effect during the reporting period. The future work will be re-scoped to meet the requirements of the new scope of work. During the report period work was underway to address numerical problems present during simulation of low-wind-speed, stable, atmospheric conditions with FEM3A. Steps 1 and 2 in the plan outlined in the first Quarterly report are complete and steps 3 and 4 are in progress. During this quarter, the University of Arkansas has been investigating the effect upon numerical stability of the heat transfer model used to predict the surface-to-cloud heat transfer, which can be important for LNG vapor dispersion. Previously, no consideration has been given to ground cooling as a result of heat transfer to the colder gas cloud in FEM3A.

NTIS

Liquefied Natural Gas; Safety

20050199665 Cincinnati Univ., OH, USA

Dual Phase Membrane for High Temperature CO(sub 2) Separation

Lin, J. Y. S.; Chung, S.; Anderson, M.; Mar. 2005; 18 pp.; In English

Report No.(s): DE2005-838118; No Copyright; Avail: Department of Energy Information Bridge

This project is intended to expand upon the previous year's research en route to the development of a sustainable dual phase membrane for CO(sub 2) separation. It was found that the pores within the supports had to be less than 9 (micro)m in order to maintain the stability of the dual phase membrane. Pores larger than 9 (micro)m would be unable to hold the molten carbonate phase in place, rendering the membrane ineffective. Calculations show that 80% of the pore volume of the 0.5 media grade metal support was filled with the molten carbonate. Information obtained from EDS and SEM confirmed that the molten carbonate completely infiltrated the pores on both the contact and non-contact size of the metal support. Permeation tests for CO(sub 2) and N(sub 2) at 450-750 C show very low permeance of those two gases through the dual phase membrane, which was expected due to the lack of ionization of those two gases. Permeance of the CO(sub 2) and O(sub 2) mixture was much higher, indicating that the gases do form an ionic species, CO(sub 3)(sup 2-), enhancing transport through the membrane. However, at temperatures in excess of 650 C, the permeance of CO(sub 3)(sup 2-) decreased quite rapidly, while predictions showed that permeance should have continued to increase. XRD data obtained from the surface of the membrane indicated the formation of lithium iron oxides on the support.

NTIS

Carbon Dioxide; Carbonates; High Temperature; Membranes

20050199668 Texas A&M Univ., College Station, TX, USA

CO(sub 2) Sequestration Potential of Texas Low-Rank Coals. Quaterly Technical Progress Report

Mcvay, D. A.; Ayers, W. B.; Jensen, J. L.; Feb. 2005; 16 pp.; In English

Report No.(s): DE2005-837839; No Copyright; Avail: Department of Energy Information Bridge

The objectives of this project are to evaluate the feasibility of carbon dioxide (CO(sub 2)) sequestration in Texas low-rank coals and to determine the potential for enhanced coalbed methane (CBM) recovery as an added benefit of sequestration. There were three main objectives for this reporting period, which related to obtaining accurate parameters for reservoir model description and modeling reservoir performance of CO(sub 2) sequestration and enhanced coalbed methane recovery. The first objective was to collect and desorb gas from 10 sidewall core coal samples from an Anadarko Petroleum Corporation well (APCL2 well) at approximately 6,200-ft depth in the Lower Calvert Bluff Formation of the Wilcox Group in east-central Texas. The second objective was to measure sorptive capacities of these Wilcox coal samples for CO(sub 2), CH(sub 4), and N(sub 2). The final objective was to contract a service company to perform pressure transient testing in Wilcox coal beds in a shut-in well, to determine permeability of deep Wilcox coal. Bulk density of the APCL2 well sidewall core samples averaged 1.332 g/cc. The 10 sidewall core samples were placed in 4 sidewall core canisters and desorbed. Total gas content of the coal (including lost gas and projected residual gas) averaged 395 scf/ton on an as-received basis.

NTIS

Carbon Dioxide; Coal; Fuels; Gas Recovery; Methane

20050199672 Electric Power Research Inst., Palo Alto, CA, USA

Toxicological Evaluation of Realistic Emissions of Source Aerosols (Teresa): Application to Power Plant-Derived PM(sub 2.5). Semi-Annual Technical Progress Report

Dec. 02, 2004; 28 pp.; In English

Report No.(s): DE2005-835875; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

Aerosols; Health; Toxicity

20050199674 Tenmat Ltd., Manchester, UK

Experiences of the Application of Hot Gas Filtration to Industrial Processes

Lloyd, B. T.; January 2005; 14 pp.; In English

Report No.(s): DE2005-835837; No Copyright; Avail: Department of Energy Information Bridge

Hot Gas Filtration (HGF) is defined as the dry scrubbing of gaseous process effluent above 250 degrees. The potential applications for this technology can be found in Atmospheric Pollution Control (APC) and In-Line Equipment Protection (ILETP). In recent years novel rigid refractory filter media have emerged with several advantages over conventional fabric bag filters and other particulate arrestment systems e.g. electrostatic precipitators. A study has been made of the effect of a wide range of operational conditions, including gas volume and velocity, temperature, particle size distribution, and organic/moisture content, in real process situations on filter elements performance and life expectancy.

NTIS

Ceramic Fibers; Cleaning; Filtration; High Temperature Gases

20050199678 Pacific Northwest National Lab., Richland, WA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Sandia National Labs., Albuquerque, NM USA

Development of Biodegradable Isosaccharinate-Containing Foams for Decontamination of Actinides: Thermodynamic and Kinetic Reactions between Isosaccharinate and Actinides on Metal and Concrete Surfaces

Rai, D.; Rao, L.; Moore, R. C.; Bontchev, R.; Holt, K.; January 2005; 16 pp.; In English

Report No.(s): DE2005-838674; No Copyright; Avail: Department of Energy Information Bridge

Actinide contamination of steel and concrete surfaces is a major problem within the DOE complex. Almost all current decontamination technologies rely on removal of the contaminated surface layer by mechanical means or by chemical methods using harsh chemicals. Some of the technologies are ineffective. Others are expensive, labor intensive, and hazardous to workers. Still others create secondary mixed wastes that are not environmentally acceptable. This project seeks fundamental information that will lead to the development of a new and more environmentally acceptable technology for decontamination of actinides, especially Pu, on steel and concrete surfaces. The key component of this technology is isosaccharinate (ISA), a degradation product of cellulose materials that is biodegradable. Isosaccharinate will be incorporated into foams/gels for safe and easy use in decontamination of actinides from steel, concrete, and other surfaces. Thermodynamic data are being developed on ISA species as a function of pH and on ISA interactions with actinides and competing metals (e.g., Fe(III) and Ca(II)) under a wide range of conditions relevant to decontamination of steel and concrete. The efficiency of the ISA containing foams/gels/solutions for decontamination is also being tested. This project builds on capabilities at three different national laboratories, and represents a joint effort between PNNL, LBNL, and SNL.

NTIS

Actinide Series; Biodegradability; Concretes; Decontamination; Foams; Metal Surfaces; Thermodynamics

20050199679 National Renewable Energy Lab., Golden, CO USA, Environmental Protection Agency, Washington, DC USA, Louisiana State Univ., Baton Rouge, LA USA

Comparison of Methods for Estimating of the NO(Sub x) Emission Impacts of Energy Efficiency and Renewable Energy Projects: Shreveport, Louisiana Case Study

Chambers, A.; Kline, D. M.; Vimmerstedt, L.; Diem, A.; Dismkes, D.; Mar. 2005; 34 pp.; In English

Report No.(s): DE2005-15011459; NREL/TP-710-37721; No Copyright; Avail: Department of Energy Information Bridge

This is a case study comparing methods of estimating the NO_x emission impacts of energy efficiency and renewable energy projects in Shreveport, Louisiana.

NTIS

Energy Conservation; Nitrogen Oxides; Renewable Energy

20050199680 Savannah River Ecology Lab., Aiken, SC, USA

Loading Capacities for Uranium, Plutonium and Neptunium in High Caustic Nuclear Waste Storage Tanks Containing Selected Sorbents

January 2005; 32 pp.; In English

Report No.(s): DE2005-835625; WSRC-MS-2004-00822; No Copyright; Avail: Department of Energy Information Bridge

In this study the loading capacities of selected actinides onto some of the most common sorbent materials which are present in caustic nuclear waste storage tanks have been determined. Some of these transition metal oxides and activated carbons easily absorb or precipitate plutonium, neptunium and even uranium, which if care is not taken may lead to unwanted accumulation of some of these fissile materials in nuclear waste tanks during waste processing. Based on a caustic synthetic salt solution simulant bearing plutonium, uranium and neptunium and "real" nuclear waste supernate solution, the loading capacities of these actinides onto iron oxide (hematite), activated carbon and anhydrous sodium phosphate have been determined. The loading capacities for plutonium onto granular activated carbon and iron oxide (hematite) in a caustic synthetic salt solution were, respectively, 3.4 0.22 plus or minus and 5.5 plus or minus 0.38 microgram per gram of sorbent. The loading capacity for plutonium onto a typical nuclear waste storage tank sludge solids was 2.01 microgram per gram of sludge solids. The loading capacities for neptunium onto granular activated carbon and iron oxide (hematite) in a caustic synthetic salt solution were, respectively, 7.9 plus or minus 0.52 and greater than 10 microgram per gram of sorbent. The loading capacity for neptunium onto a typical nuclear waste storage tank sludge solids was 4.48 microgram per gram of sludge solids. A typical nuclear waste storage tank solid material did not show any significant affinity for uranium. Sodium phosphate showed significant affinity for both neptunium and uranium, with loading capacities of 6.8 and 184.6 plus or minus 18.5 microgram per gram of sorbent, respectively.

NTIS

Actinide Series; Alkalies; Neptunium; Plutonium; Radioactive Wastes; Sorbents; Storage Tanks; Uranium

20050199690 California Univ., Davis, CA, USA

Near-Source Measurement of Crystalline Silica Concentrations in California: Pilot Study

Holmen, B. A.; Shiraki, R.; Aug. 2001; 112 pp.; In English

Contract(s)/Grant(s): CARB-98-348

Report No.(s): PB2005-107588; No Copyright; Avail: CASI; [A06](#), Hardcopy

Quantitative determination of crystalline silica (CS) concentrations in air samples downwind of industrial sources is required to determine the general population's exposure to this potentially toxic air contaminant. A Pilot Study was carried out to develop methods to characterize near-source CS concentrations in air samples collected at multiple distances downwind of a stationary source. The sampling and analysis involved the following: (1) collection of PM (sub 2.5) and PM (sub 10), and size resolved PM samples downwind of a representative CS stationary source in California; (2) collection of bulk source material and determination of the composition of PM (sub 10) derived from the source material; (3) analysis of the CS in the near-source air samples and the bulk source material. Analytical techniques included x-ray diffraction (XRD) techniques that are specific for CS, proton-induced X-ray emission (PIXE) and PM (sub 10) and PM (sub 2.5) filter samples to identify a trace element 'fingerprint' of the source material, and scanning electron microscopy (SEM). Light detection and ranging (lidar) was also used to monitor the dust plume characteristics downwind of the source.

NTIS

Air Sampling; Crystallinity; Silicon Dioxide

20050199691 California Univ., Irvine, CA, USA

Study to Evaluate the Effect of Reduced Greenhouse Gas Emissions on Vehicle Miles Traveled

Small, K. A.; Van Dender, K.; Mar. 2005; 96 pp.; In English

Report No.(s): PB2005-107586; CARB-02-336; No Copyright; Avail: CASI; [A05](#), Hardcopy

This report presents measures of the size of the rebound effect, by which improvements in fuel efficiency of vehicles may cause vehicle travel to increase. We use aggregate cross-sectional time series data for 1966 to 2001 on all 50 U.S. state and the District of Columbia. Our model contains a measure of the historical effects of the federal Corporate Average Fuel Economy (CAFE) standards, which helps stabilize results compared to previous literature. Also, our time series is longer than previous studies, enabling us to better discern the difference between short and long run effects. Our best estimate of the rebound effect for the US as a whole, over the period 1966-2001, is 5.3% for the short run and 26% for the long run. We also found that the rebound effect declines with income. Using the 1997-2001 average value of income for California, the short and long run rebound effects are estimated at 2.2% and 11.3%, respectively. Our methodology permits projections to future years, including dynamic projections accounting for changes in income occurring at the same time as owners are adjusting

from the short to the long run. These results enable researchers to predict how proposed standards for greenhouse gas emissions in California may affect the amount of vehicle ownership and travel.

NTIS

Air Pollution; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Motor Vehicles; Pollution Control

20050199692 National Inst. for Occupational Safety and Health, Washington, DC, USA

NIOSH Health Hazard Evaluation Report: HETA No. 2003-0367-2973, OmniSource Corporation, Lima, Ohio, July 2005

Jul. 2005; 32 pp.; In English

Report No.(s): PB2005-107577; HETA-2003-0367-2973; No Copyright; Avail: CASI; [A03](#), Hardcopy

On September 8, 2003, the National Institute for Occupational Safety and Health (NIOSH) received a Health Hazard Evaluation request from the Corporate Director of Safety of the OmniSource Corporation to evaluate cutting of scrap metal at a recycling facility in Lima, Ohio. The request asked NIOSH investigators to determine the need for showers for employees whose lead exposures exceeded the Occupational Safety and Health Administration's Permissible Exposure Limit. Workers identified as having elevated exposures to lead were those who use oxygen/propane torches to cut bulk scrap into smaller pieces using hand-held oxygen/propane torches.

NTIS

Environmental Surveys; Hazards; Health; Metal Working; Safety

20050199694 Syracuse Univ., NY USA

International Innovation and Diffusion of Environmental Technologies: The Case of NO(sub X)

Popp, D.; January 2005; 12 pp.; In English

Report No.(s): DE2005-834472; No Copyright; Avail: Department of Energy Information Bridge

This research traces the development of nitrogen dioxide (NOX) and sulfur dioxide (SO2) pollution control devices for coal-fired power plants in the USA, Japan, and Germany. This is of particular interest because of the timing of regulation in each country. While the US was an early adopter of SO2 regulations, it did not adopt stringent NOX regulations until the 1990s. Both Japan and Germany adopted stringent NOX regulations earlier. As such, advanced control techniques such as selective catalytic reduction (SCR) were first developed in Japan and Germany. In contrast, US firms were more active in the development of SO2 control devices. This study uses patent data from the three countries, as well as adoption data for individual plants, to trace the development of these technologies. Of particular interest is the role of technology transfer. While we know from previous research that firms respond to new regulations in their own country with new innovations, we do not know the extent to which firms respond to regulations in foreign countries. Moreover, we know little about how innovations developed abroad enter the domestic knowledge base. For example, do firms make direct use of knowledge developed in foreign countries, or is domestic R&D necessary to adapt these innovations to local conditions. Understanding such trends is important, as it affects both the speed at which technology will diffuse, and the cost of technology transfer. To address these issues, this research compares the role that domestic and foreign knowledge play in the decisions of firms to adopt new environmental technologies. I begin by using patent and regulatory data from the U.S., Japan, and Germany to study the links between both domestic and foreign environmental policy and innovation. I show that innovative activity responds to domestic environmental policy pressures, but not to foreign pressures. Moreover, even countries that adopt regulations late, such as the U.S. in the case of NOX, increase innovative activity in response to new domestic regulations.

NTIS

Air Pollution; Control Equipment; Diffusion; Pollution Control

20050199733 Lawrence Livermore National Lab., Livermore, CA USA

Lawrence Livermore National Laboratory DOE-STD-3013 Surveillance Program for the Storage of Plutonium Packages

Riley, D. C.; Jan. 07, 2005; 12 pp.; In English

Report No.(s): DE2005-15014612; UCRL-TR-208875; No Copyright; Avail: Department of Energy Information Bridge

This document presents a site-specific DOE-STD-3013 (3013) surveillance program for 3013 material stored at Lawrence Livermore National Laboratory (LLNL) in the B332 Plutonium Facility. The 3013 standard requires the development of a surveillance program to assure the long-term safety of plutonium storage in 3013 compliant containers. A complex-wide Integrated Surveillance Program in Support of Long-Term Storage of Plutonium-Bearing Materials (ISP)(LA-UR-00-3246, Revision 1, March 2001) has been developed to give guidance on an acceptable surveillance approach and to set up a

mechanism to integrate surveillance activities and facilitate the sharing of lessons learned. This LLNL 3013 surveillance program has been developed following guidelines established for Storage Sites in the ISP and is sufficient for the storage in the LLNL Plutonium Facility. The LLNL 3013 surveillance program must be coupled with the DOE complex wide Materials Identification and Surveillance (MIS) program and the ISP led by Savannah River Site (SRS). These programs support the technical basis for continuing safe storage of plutonium packages and provide the technical basis for the limited scope of the site-specific LLNL 3013 surveillance program.

NTIS

Plutonium; Radioactive Wastes; Surveillance; Waste Management

20050199736 Lawrence Livermore National Lab., Livermore, CA USA

Assessment of the Current Day Impact of Various Materials Associated with the U.S. Nuclear Test Program in the Marshall Islands

Robison, W. L.; Noshkin, V. E.; Hamilton, T. F.; Conrado, C. L.; Bogen, K. T.; May 01, 2001; 34 pp.; In English

Report No.(s): DE2005-15013358; UCRL-LR-143980; No Copyright; Avail: Department of Energy Information Bridge

Different stable elements, and some natural and man-made radionuclides, were used as tracers or associated in other ways with nuclear devices that were detonated at Bikini and Enewetak Atolls as part of the U.S. nuclear testing program from 1946 through 1958. The question has been raised whether any of these materials dispersed by the explosions could be of sufficient concentration in either the marine environment or on the coral islands to be of a health concern to people living, or planning to live, on the atolls. This report addresses that concern. An inventory of the materials involved during the test period was prepared and provided to us by the Office of Defense Programs (DP) of the USA Department of Energy (DOE). The materials that the DOE and the Republic of the Marshall Islands (RMI) ask to be evaluated are--sulfur, arsenic, yttrium, tantalum, gold, rhodium, indium, tungsten, thallium, thorium, uranium, polonium, curium, and americium-241. The stable elements were used primarily as tracers for determining neutron energy and flux, and for other diagnostic purposes in the larger yield, multistage devices.

NTIS

Nuclear Explosions; Pacific Islands; Radioactive Isotopes

20050200842 Massachusetts General Hospital, Boston, MA USA

Evaluation of Early and Prolonged Effects of Acute Neurotoxicity and Neuroprotection Using Novel Functional Imaging Techniques

Brownell, Anna-Liisa; Westbrook, Gary; Correia, John A.; Klaess, Thomas; Canales, Kelly; Wang, Xukui; Yu, Meixiang; Jenkins, Bruce G.; Cicchetti, Francesca; Nagren, Kjell; Aug. 2004; 88 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9555

Report No.(s): AD-A435370; No Copyright; Avail: CASI; [A05](#), Hardcopy

The wide use of herbicides and pesticides has increased the risk for environmental toxicity (Reiter et al 1998, Gorrell et al 1996). In addition, airborne environmental toxicity has continuously increased (Zayed et al 1996). In addition, recent findings suggest that environmental proteasome inhibitors, like naturally occurring epoximicin, are candidates for Parkinson's disease causing toxins (McNaught, 2004). Exogenous and endogenous neurotoxicity present a major challenge in developing specific and sensitive in vivo methods to determine pathophysiological mechanisms of toxins. This information is essential in order to design new methods for neuroprotection and therapy. Our overall research goal proposed to develop and improve in vivo imaging techniques to examine neurofunction of dopaminergic and glutamatergic receptors as well as oxidative glucose metabolism and neurochemicals. High resolution imaging techniques were developed and used to explore the excitotoxicity induced regional neuronal dysfunction in functional and metabolic pathway. The neuronal toxicity models included two animal models: rats with 3-nitropropionic acid induced striatal lesions and transgenic mice with gene expression of human Huntington's disease (HD). In the final phase of this project we tested neuroprotection with novel newly developed ligands effecting on metabotropic glutamate receptor function as well as a ligand, which is a transglutaminase inhibitor.

DTIC

Image Reconstruction; Imaging Techniques; Magnetic Resonance; Toxicity

20050201091 Army Construction Engineering Research Lab., Champaign, IL USA

Inhalation Toxicity of Cogenerated Graphite Flake and Fog Oil Smoke in the Brown-Headed Cowbird and the Red-Winged Blackbird, Size-Specific Inhalation Surrogates for the Red-Cockaged Woodpecker

Driver, Crystal; Fulton, Robert; Ollero, Jennifer; Clark, Mark; Dennis, Gary; Tiller, Brett; Balbach, Harold E.; Jan. 2005; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435890; ERDC/CERL-TR-05-5; No Copyright; Avail: Defense Technical Information Center (DTIC)

The red-cockaded woodpecker (*Picoides borealis*) is an endangered species found on many installations where troop readiness training is conducted. Conducting maneuvers under obscurant cover is important for realistic training. Generators that combine fog oil for visual obscuration with graphite flakes for infrared obscuration are being deployed for training scenarios. The effect of this combination on avian species was unknown. Our data indicate that toxicity of inhaled and/or preened graphite flake and cogenerated graphite flake and fog oil is low and similar to controls for adult cowbird and blackbird surrogates for the red-cockaded woodpecker. No mortality, body weight loss, clinical signs of toxicity, or respiratory function deficits were observed in the graphite flake-only, or cogenerated graphite flake/fog oil-treated birds when compared to controls. Hematological response was normal and no toxic effects in erythrocytes or leukocytes were found. White blood cell counts, spleen weights, and incidence of parasitism and disease were indicative of normal immune function in all treatments. Because repeated exposure that may result in particle overload in the lung has the greatest potential for causing harm to birds, it is suggested that exposures to high concentrations of the aerosol-graphite mixture be limited to fewer than eight within any 2-month period.

DTIC

Birds; Endangered Species; Flakes; Fog; Graphite; Oils; Respiration; Smoke; Toxicity

20050201100 Army Construction Engineering Research Lab., Champaign, IL USA

Ecological Risk Assessment of the Effects of Military Fog Oil Obscurant Smoke on the Red-cockaded Woodpecker

Smith, Thomas; Hohmann, Matthew G.; Melton, Robert H.; Jan. 2005; 96 pp.; In English; Original contains color illustrations
Report No.(s): AD-A435919; ERDC/CEERL-TR-05-4; No Copyright; Avail: Defense Technical Information Center (DTIC)

To satisfy its mission of wartime readiness, the U.S. Army relies on extensive troop training at military installations. These installations must comply with the mandates of Congressional directives and other regulations, including the Endangered Species Act (16 USC 1531-1544). Because the military is required to protect State and Federally listed threatened and endangered species on its lands, the Army and other military services must evaluate any activities that are potentially harmful to threatened and endangered species and their habitats. Toward that end, the Army has initiated studies to evaluate any potential impacts and effects of certain military-specific soldier training actions and activities on threatened and endangered species. Considerable study and management effort have been devoted to the red-cockaded woodpecker (*Picoides borealis*), in part because of its relatively widespread occurrence on installations. This report provides an assessment of the ecological risks that fog oil obscurant smoke training may pose to individual red-cockaded woodpeckers, red-cockaded woodpecker populations, and red-cockaded woodpecker habitat. The risks from military fog oil obscurants do not appear to be significant in field use.

DTIC

Assessments; Ecology; Endangered Species; Fog; Occultation; Oils; Risk; Smoke

20050201641 Minerals Management Service, New Orleans, LA USA

Air Quality: User's Guide for the Gulfwide Offshore Activities Data System (GOADS)

Wilson, D.; Blackard, A.; Finn, S.; Boyer, B.; Jul. 2001; 108 pp.; In English

Report No.(s): PB2005-100033; OCS-MMS-2001-052; No Copyright; Avail: CASI; [A06](#), Hardcopy

Contents: Introduction (Principles of use and system requirements, Installation); Using the Gulfwide Offshore Activities Data System (GOADS) (Starting and exiting GOADS, Creating and Editing Data, Quality control tests, Saving and backing up work, Setting status of facilities and equipment, Finding help and extra information); UPON Survey Completion (How, when, and where to deliver data files, Failed quality control tests, QA Summary form); Appendix A: Help Text Files, Appendix B: GOADS QA Summary form data fields.

NTIS

Air Quality; Data Systems

20050201927 EnviRes, LLC, Lexington, KY, USA

Reducing Ultra-Clean Transportation Fuel Costs with HyMelt(Trade Name) Hydrogen. (Quarterly Report, July 1-September 30, 2004)

Malone, D. P.; Renner, W. R.; Oct. 2004; 12 pp.; In English

Report No.(s): DE2005-834509; No Copyright; Avail: Department of Energy Information Bridge

Phase I of the work to be done under this agreement consists of conducting atmospheric gasification of coal using the HyMelt technology to produce separate hydrogen rich and carbon monoxide rich product streams. In addition smaller quantities of petroleum coke and a low value refinery stream will be gasified. DOE and EnviRes will evaluate the results of

this work to determine the feasibility and desirability of proceeding to Phase II of the work to be done under this agreement, which is gasification of the above-mentioned feeds at a gasifier pressure of approximately 5 bar. The results of this work will be used to evaluate the technical and economic aspects of producing ultra-clean transportation fuels using the HyMelt technology in existing and proposed refinery configurations.

NTIS

Clean Fuels; Costs; Hydrogen; Transportation

20050201933 Texas-Pan American Univ., San Antonio, TX, USA

Control of Pollutant Emissions in Natural Gas Diffusion Flames by using Cascade Burners. (Semiannual Report, September 1, 2000-February 28, 2001)

Qubbaj, A.; Mar. 2001; 16 pp.; In English

Report No.(s): DE2005-833196; No Copyright; Avail: Department of Energy Information Bridge

The advanced CFDRC software package was installed on a SUN-SPARC dual processor workstation (UTPA funded). The literature pertinent to the project was collected. The physical model was set and all parameters and variables were identified. Based on the physical model, the geometric modeling and grid generation processes were performed using the CFD-GEOM (Interactive Geometric Modeling and Grid Generation software). A total number of 11160 cells (24845) were generated. The venturis in the cascade were modeled as two-dimensional axisymmetric convergent nozzles around the jet. With the cascade being added to the jet, the geometric complexity of the problem increased; which required multi-domain structured grid systems to be connected and matched on the boundaries. The natural gas/propane jet diffusion flame is being numerically analyzed. The numerical computations are being conducted using the CFDRC-ACE+ (advanced computational environment) software package.

NTIS

Burners; Contaminants; Diffusion Flames; Exhaust Emission; Flames; Gaseous Diffusion; Natural Gas

20050201942 RTI International, Research Triangle Park, NC, USA

Verification Testing of Air Pollution Control Technology: Quality Management Plan. Revision 2.2

Feb. 17, 2005; 54 pp.; In English

Report No.(s): PB2005-109261; No Copyright; Avail: CASI; [A04](#), Hardcopy

This quality management plan (QMP) applies to RTI International's (RTI's) Air Pollution Control Technology Verification Center (APCT Center) operated under U.S. Environmental Protection Agency (EPA) Cooperative Agreement CR-831911-01. The APCT Center was established in 1995 as part of the EPA's Environmental Technology Verification (ETV) Program to accelerate the development and commercialization of improved environmental technologies through third-party verification testing and reporting on the tested technologies' performance. The APCT Center verifies the environmental performance of commercial-ready technologies in collaboration with qualified testing organizations (TOs). Verification provides potential purchasers and permittees with an independent and credible assessment of what they are buying and permitting. Verification testing is performed according to approved protocols. A technology's verified performance is reported in verification statements signed by EPA.

NTIS

Air Pollution; Control Equipment; Inspection; Management Planning; Pollution Control; Proving; Technology Assessment; Volatile Organic Compounds

20050201946 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

EPA-CMB8.2 Users Manual

Coulter, C. T.; Dec. 2004; 128 pp.; In English

Report No.(s): PB2005-108911; EPA-452/R-04-011; No Copyright; Avail: CASI; [A07](#), Hardcopy

The Chemical Mass Balance (CMB) air quality model is one of several receptor models that have been applied to air resources management. EPA-CMB8.2 incorporates the upgrade features that CMB8 has over CMB7, but also corrects errors/problems identified with CMB8 and adds enhancements for a more robust and user-friendly system. EPA-CMB8.2 is a 32-bit (Windows (Trademark) 9x and higher) version of CMB modeling software that substantially facilitates the estimation of source contributions to speciated PM10 (particles with aerodynamic diameters nominally less than 10mm), PM2.5 (particles with aerodynamic diameters nominally less than 2.5mm), and Volatile Organic Compounds (VOC) data sets. EPA-CMB8.2 features: (1) full use of Windows (32-bit) for file access/management, (2) a tabbed page interface that eases the necessary progression for doing a CMB calculation, (3) multiple, indexed arrays for selecting fitting sources and species, (4) versatile

display capability for ambient data and source profiles, (5) mouse-overs and on-line help screens, (6) increased attention to volatile organic compounds (VOC) applications, (7) correction of some flaws in the previous version (CMB7), (8) flexible options for input/output data formats, (9) addition of a more accurate least squares computational algorithm, (10) upgraded linear algebra library, (11) a new treatment of source collinearity, and (12) choice of criteria for determining best fit.

NTIS

Air Quality; Balance; Environment Models; Mass Distribution; User Manuals (Computer Programs)

20050201955 California Univ., Davis, CA, USA

Quality Assurance Analysis of Filter Samples Collected During the Lake Tahoe Atmospheric Deposition Study Using Synchrotron X-Ray Fluorescence (LTADS-sXRF QA)

Cliff, S. S.; Apr. 2005; 38 pp.; In English

Contract(s)/Grant(s): ARB-03-344

Report No.(s): PB2005-107593; No Copyright; Avail: CASI; [A03](#), Hardcopy

Results for analysis of a subset of 71 Lake Tahoe Atmospheric Deposition Study (LTADS) ambient sample filters via synchrotron sourced x-ray fluorescence (s-XRF) are presented. A rigorous statistical analysis of phosphorous concentration data reveals a lower quantifiable limit of 15 nanograms per cubic meter for the s-XRF analysis results and 30 ng/cu. meters for DRI analyses for the LTADS ambient filters. Comparison of results for major elements between the s-XRF and DRI technique indicates no significant bias between analytical protocols for ambient samples. Additionally, 21 source samples (7 smoke and 14 roadway) were analyzed via s-XRF. In contrast to the ambient samples, differences were observed when comparing datasets. A non-uniform deposit on the source samples, however, is suggested as being responsible for the observed differences in quantitative results when comparing the s-XRF and DRI data.

NTIS

Air Pollution; Deposition; Lake Tahoe (CA-NV); Pollution Monitoring; Quality Control; Synchrotron Radiation; Synchrotrons; X Ray Fluorescence; X Rays

20050201958 California Univ., Davis, CA, USA

Oxygenated Organics in Fine Particle Emissions from Gasoline and Diesel Vehicles for Source Apportionment

Jakober, C. A.; Riddle, S. G.; Robert, R. A.; Cahill, T. M.; Kleeman, M. J.; Feb. 2005; 136 pp.; In English

Contract(s)/Grant(s): CARB-00-318

Report No.(s): PB2005-107589; No Copyright; Avail: CASI; [A07](#), Hardcopy

Gaseous and particulate emissions from light-duty gasoline (LDV) and heavy-duty diesel (HDV) vehicles were collected using a denuder-filter-polyurethane foam sampling train. The particulate emissions were analyzed for carbonyls, organic acids and polycyclic aromatic hydrocarbons using gas chromatography-ion trap mass spectrometry in conjunction with multiple derivatization techniques.

NTIS

Exhaust Emission; Gasoline; Oxygenation; Particle Emission; Particulates

20050201986 Department of Energy, Washington, DC, USA

Waste Heat Reduction and Recovery for Improving Furnace Efficiency, Productivity and Emissions Performance: A BestPractices Process Heating Technical Brief

January 2005; 14 pp.; In English

Report No.(s): DE2005-15011680; No Copyright; Avail: Department of Energy Information Bridge

This technical brief is a guide to help plant operators reduce waste heat losses associated with process heating equipment.

NTIS

Air Pollution; Furnaces; Heating; Heating Equipment; Pollution Control; Waste Energy Utilization

20050202000 Lawrence Livermore National Lab., Livermore, CA USA

ARAC Modeling of the Algeciras, Spain Steel Mill CS-137 Release

Vogt, P. J.; Pobanz, B. M.; Aluzzi, F. J.; Baskett, R. L.; Sullivan, T. J.; May 01, 1999; 16 pp.; In English

Report No.(s): DE2005-15013432; UCRL-JC-13729; No Copyright; Avail: Department of Energy Information Bridge

On 12 June 1998, the Atmospheric Release Advisory Capability (ARAC) learned from news reports about the accidental release of cesium-137 from a steel mill near Algeciras, Spain. We used the U.S. Navy Operational Global Atmospheric Prediction System (NOGAPS) gridded data for meteorological input into our diagnostic models. To better resolve near-release

location and coastal meteorological conditions, we blended four days of WMO surface and upper air observations with the gridded data. Our calculations showed the plume initially traveled eastward over the Mediterranean Sea, turned northward into central Europe, and was split by the Alps. We determined the timing and amount of cesium released by fitting our modeled air concentrations to the available set of measurements. Accuracy statistics from a small set of ratios of measured to computed air concentrations paired in space and time were similar to those achieved from larger data sets in previous ARAC model evaluation studies on the continental scale.

NTIS

Air Pollution; Cesium 137; Pollution Monitoring; Spain; Steels

46

GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20050200999 Air Force Research Lab., Hanscom AFB, MA USA

Ionospheric Modification at Twice the Electron Cyclotron Frequency

Djuth, F. T.; Pedersen, T. R.; Gerken, E. A.; Bernhardt, P. A.; Selcher, C. A.; Bristow, W. A.; Kosch, M. J.; Apr. 2005; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2311; Proj-1010

Report No.(s): AD-A435721; AFRL-VS-HA-TR-2005-1070; No Copyright; Avail: Defense Technical Information Center (DTIC)

In 2004, a new transmission band was added to the HAARP high-frequency ionospheric modification facility that encompasses the second electron cyclotron harmonic at altitudes between ~ 220 and 330 km. Initial observations indicate that greatly enhanced airglow occurs whenever the transmission frequency approximately matches the second electron cyclotron harmonic at the height of the upper hybrid resonance. This is the reverse of what happens at higher electron cyclotron harmonics. The measured optical emissions confirm the presence of accelerated electrons in the plasma.

DTIC

Cyclotron Frequency; Cyclotron Radiation; Cyclotrons; Electrons; High Frequencies; Ionospheric Disturbances

20050201006 Air Force Research Lab., Hanscom AFB, MA USA

Creation of Visible Artificial Optical Emissions in the Aurora by High-Power Radio Waves

Pedersen, Todd R.; Gerken, Elizabeth A.; Feb. 2005; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2311; Proj-1010

Report No.(s): AD-A435730; AFRL-VS-HA-TR-2005-1069; No Copyright; Avail: Defense Technical Information Center (DTIC)

Generation of artificial light in the sky by means of high-power radio waves interacting with the ionospheric plasma has been envisaged since the early days of radio exploration of the upper atmosphere, with proposed applications ranging from regional night-time street lighting to atmospheric measurements. Weak optical emissions have been produced for decades in such ionospheric 'heating' experiments, where they serve as key indicators of electron acceleration, thermal heating, and other effects of incompletely understood wave-particle interactions in the plasma under conditions difficult to replicate in the laboratory. The extremely low intensities produced previously have, however, required sensitive instrumentation for detection, preventing applications beyond scientific research. Here we report observations of radio-induced optical emissions bright enough to be seen by the naked eye, and produced not in the quiet mid-latitude ionosphere, but in the midst of a pulsating natural aurora. This may open the door to visual applications of ionospheric heating technology or provide a way to probe the dynamics of the natural aurora and magnetosphere.

DTIC

Auroras; Emission; Optical Waveguides; Radio Waves; Visible Spectrum

20050201040 Massachusetts Univ., Lowell, MA USA

Imaging and Forecasting of Ionospheric Structures and Their System Impacts

Reinisch, Bodo; Sales, Gary; Song, Paul; Jan. 2005; 76 pp.; In English

Contract(s)/Grant(s): F19628-02-C-0092; Proj-2311

Report No.(s): AD-A435788; AFRL-VS-HA-TR-2005-1036; No Copyright; Avail: CASI; [A05](#), Hardcopy

The COPEX attention was focused on the details of the early stages in the development of ionospheric (F-region) instabilities that precede the growth of equatorial bubbles. We continued our work on ground VLF station monitoring with the RPI/IMAGE instrument. We carried out RPI measurements using specifically designed operational modes with lower receiver gains. In the past year, several Radiation Belt Remediation (RBR) studies were done and many of them remain active. The results of two HAARP heating experiments with the digisonde at Gakona, Alaska are described. Additionally, we discuss work done in several areas. We introduced a new Java-based Drift software package for the digisonde drift data analysis and visualization. DISS Support for the Digisonde Network continued. The CAL/VAL, project which involved the establishment of a substantial database from a global network of digisondes, is described. Product and the improvements offered by ARIST 4.5 are discussed.

DTIC

Computer Programs; Forecasting; Images; Imaging Techniques; Ionospheres; Very Low Frequencies

20050201090 Arizona State Univ., Tempe, AZ USA

Statistics and Variability of Turbulence Dynamics in the Middle Atmosphere

Mahalov, Alex; Nicolaenko, Basil; Jul. 2005; 45 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0026

Report No.(s): AD-A435888; AFRL-SR-AR-TR-05-0309; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project falls within the realm of the USAF mission of developing air defense systems, a component of which is the ongoing Airborne Laser (ABL) program. The recent congressional mandate to develop an airborne missile defense system for the US will bolster the ABL program, since laser technology is a viable tool for such an effort. One of the major challenges of the ABL program is the development of laser-beam propagation codes. Such codes must account for the beam propagation through an extended turbulent medium, consisting of the bulk of the troposphere and stratosphere. From the operational perspective (Atmospheric Decision Aid, ADA), rigorous modeling of the refractive index structure function for long horizontal or nearly horizontal paths under high scintillation conditions characteristic of the atmosphere is imperative. In spite of demonstrated importance of stratification on atmospheric optical turbulence, currently available ABL phase screen theories hinge upon isotropic Kolmogorov spectrum (Rytov's theory), and hence cannot represent large amplitude fluctuations of atmospheric stratified turbulence. In the context of such turbulence the collusion between the stratification and shear leads to many intriguing phenomena such as the formation of thin, elongated turbulent layers (pancakes) and instabilities (such as Kelvin-Helmholtz (K-H) billowing, Figure 13) that ultimately break down into turbulence. The turbulence so generated is often patchy and temporally intermittent, characterized by strong anisotropy. It produces strong optical scintillation due to refractive index fluctuations, which needs to be quantified accurately in developing advanced beam control concepts for atmospheric laser-beam propagation.

DTIC

Air Defense; Atmospheric Circulation; Middle Atmosphere; Missile Defense; Turbulence; Variability

20050201706 NASA Goddard Space Flight Center, Greenbelt, MD, USA

CDDIS Data Center Summary for the 2004 IVS Annual Report

Noll, Carey; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 173-177; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes activities during the year 2004 and future plans of the Crustal Dynamics Data Information System (CDDIS) with respect to the International VLBI service for Geodesy and Astrometry (IVS). Included in this report are background information about the CDDIS, the computer architecture, staffing the support system, archive contents, and future plans for the CDDIS within the IVS.

Author

Geodynamics; Information Systems; Very Long Base Interferometry; Geophysical Observatories; Data Systems

20050201709 Wien Univ., Austria

Vienna IGG Special Analysis Center Annual Report 2004

Schuh, Harald; Boehm, Johannes; Heinkelmann, Robert; Hobiger, Thomas; Todorova, Sonja; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 221-224; In English; See also 20050201697; Original contains color and black and white illustrations

Contract(s)/Grant(s): P-16136-N06; P16992-N10; PE-04023; No Copyright; Avail: CASI; [A01](#), Hardcopy

In 2004 the Institute of Geodesy and Geophysics (IGG) at the Vienna University of Technology has continued its

investigations in atmospheric research for geodetic VLBI. Among other items, it started the comparison and combination of long time series of tropospheric parameters within the IVS ('VLBI for climate studies'). So far, six analysis centers (ACs) have agreed to take part (four ACs already submitted). This will allow a robust combination of the tropospheric parameters and a reliable determination of trends and seasonal signals in the time series.

Author

Very Long Base Interferometry; Data Processing; Geodesy; Atmospheric Physics

20050201723 National Inst. of Information and Communications Technology, Tokyo, Japan

Analysis Center at National Institute of Information and Communications Technology

Ichikawa, Ryuichi; Sekido, Manoru; Takeuchi, Hiroshi; Koyama, Yasuhiro; Hobiger, Thomas; Kondo, Tetsuro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 231-234; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of the Analysis Center at National Institute of Information and Communications Technology (NICT, former CRL) for the year 2004. By using the state-of-art e-VLBI systems, we performed the international EOP session between Westford and Kashima, differential VLBI measurements for the precise tracking the spacecraft HAYABUSA and geodetic experiments. In particular, we achieved the most rapid estimation of UT1-UTC with a latency of four and half hours. In addition, we performed ionospheric studies, the development of automatic GPS data processing system, and satellite communication experiments.

Author

Research Facilities; Data Processing; Very Long Base Interferometry; Japan

20050201737 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GSFC VLBI Analysis center

Gordon, David; Ma, Chopo; MacMillan, Dan; Petrov, Leonid; Baver, Karen; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 209-212; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report presents the activities of the GSFC VLBI Analysis Center during 2004. The GSFC Analysis Center analyzes all IVS sessions, makes regular IVS submissions of data and analysis products, and performs research and software development activities aimed at improving the VLBI technique.

Author

Very Long Base Interferometry; Research Facilities; Data Processing; Geodesy

20050201739 Deutsches Geodaetisches Forschungsinstitut, Munich, Germany

DGFI Analysis Center Annual Report for 2004

Tesmer, Volker; Hermann, Drewes; Kruegel, Manuela; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 199-202; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of the DGFI Analysis Center in 2004 and outlines the planned activities for the year 2005.

Author

Ground Stations; Very Long Base Interferometry; Geodesy; Data Processing

20050201750 Observatoire de Paris, France

Paris Observatory Analysis Center OPAR: Report on Activities, January - December 2004

Gontier, Anne-Marie; Feissel-Vernier, Martine; Barache, C.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 235-238; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

In preparation for the evolution of the definition of the VLBI-based International Celestial Reference Frame (ICRF), we studied the consequences of the status of the terrestrial reference frame in the data analysis, using a set of selected radio sources. We conclude that estimating both the celestial and terrestrial reference frames in the VLBI global analysis does not impact the quality of the celestial reference frame, and that the use of observations of the proposed set of stable sources collected since 1990 would allow an improvement by a factor of four in the maintenance of the ICRF axes, to reach 5 micro as, and by a factor of 8 in the source position precision, to reach 30 micro as. We also show that the impact of the source

selection on the determination of the sidereal orientation of the Earth may reach 300 micro as for some low frequency components.

Author

Very Long Base Interferometry; Celestial Reference Systems; Radio Sources (Astronomy); Geodetic Accuracy

20050201751 Onsala Space Observatory, Sweden

The IVS Analysis Center at the Onsala Space Observatory

Haas, Rudiger; Scherneck, Hans-Georg; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 239-242; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

We shortly summarize the activities of the IVS Analysis Center at the Onsala Space Observatory during 2004. Examples of achieved results and ongoing analyses are presented.

Author

Very Long Base Interferometry; Data Processing; Observatories; Geodesy; Earth Sciences; Geophysics

20050201827 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Volatiles in the Desert: Subtle Remote-sensing Signatures of the Dakhleh Oasis Catastrophic Event, Western Desert, Egypt

Haldemann, A. F. C.; Kleindienst, M. R.; Churcher, C. S.; Smith, J. R.; Schwarcz, H. P.; Osinski, G.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 44-45; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Over the past decade members of the Dakhleh Oasis Project have studied enigmatic signatures in the Pleistocene geologic record of portions of the Dakhleh oasis and palaeo-oasis in Egypt's Western Desert [1,2]. In particular, Si-Ca-Al rich glass melt (Dakhleh Glass, Fig. 1) points to a catastrophic event between c.100,000-200,000 years ago [3] in this well-studied African savannah and freshwater lake Middle Stone Age environment [4,5].

Derived from text

Glass; Deposits; Remote Sensing; Signatures

20050201832 Institute of Geological and Nuclear Sciences Ltd., Lower Hutt, New Zealand

Making a Grain-Bridge Connection Between Two Rocky Planets

McSaveney, Mauri J.; Davies, Tim R. H.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 73-74; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

A characteristic of large landslides of brittle rock when we look inside their deposits is that formerly intact rock is now gravelly sand. We wondered if this might affect their movement. The literature was decidedly unhelpful; there is universal acceptance of grain flow (grains and flow are irrefutable), but little interest in how grains come about. Where fracturing to produce grains is recognized, it usually is assumed to have occurred at the start of movement. An initial momentary fragmentation episode has certain dynamic implications - it is a scenario optimally achieved to dramatic effect in impact cratering. Converting a large block of hard rock to sand takes an enormous amount of energy, at least half of which is released as the rock breaks; the process is accompanied by an enormous explosion when it is instantaneous. We have compelling evidence that there is no momentary fragmentation episode at the start, fracturing occurs throughout landslide motion, and it affects the flow dynamics. We have generalized the process beyond landslides, to present the hypothesis that grain fragmentation causes hypermobility in a variety of grain flows: rock avalanches, blockslides, fault rupture, crater collapse, and ejecta emplacement. Some folks call it low friction, but it's really hypermobility. Large rock avalanches can travel approx.10 km (3.2-32 km) in approx.100 s (32-320 s); the bigger ones travel faster and further. Along with grains, come grain-flow characteristics. Flow is fast (10-100 m/s), but laminar. Structural features in the original rock mass, such as bedding, get stretched and distorted, but remain visible in the deposit from grain to grain. New structures are added at the front and base if the flow erodes the land it passes over. The surface debris behaves as if it has some finite strength while moving: it can carry large boulders; and it will fail in discrete zones of shear, rather than shear being distributed uniformly between all grains. The mass appears to slide as a thin flexible sheet as it flows. With millions to billions of tonnes of rock moving at 10-100 m/s, it is no surprise that momentum and kinetic energy are important; these are not falling feathers or tissues to be strongly affected by their environment.

Derived from text

Sands; Fragmentation; Landslides; Flow Characteristics; Debris; Ejecta; Geological Faults; Cratering; Craters

20050201833 University of Southern California, Los Angeles, CA, USA

Elastic Granular Flows

Campbell, C. S.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 1 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

A decade ago, large scale landslide simulations, designed to understand the anomalous behavior on the Earth, Moon and Mars, yielded the surprising result that the effective friction coefficient (the ratio of shear to normal forces at the base of the slide) increased with the shear rate. This might possibly explain the effect of slide volume on the runout of large landslides, but it also indicates that landslides operated in an entirely new and unexplored flow regime. Previously, granular flows had been divided into (1) the slow, quasistatic regime, in which the effective friction coefficient is taken to be a material property and thus constant, and (2) the fast, rapid-flow regime, where the particles interact collisionally, but which scales in such a way that the effective friction coefficient is independent of the shear rate. Consequently the landslides operated in a separate intermediate regime. This talk will discuss computer simulation studies into this intermediate regime and into the transitions between regimes. In this way, it is possible to draw the entire flowmap connecting the quasistatic and rapid-flow regimes. The key was to include the elastic properties of the solid material in the set of rheological parameters; in effect this put solid properties into the rheology of granular solids, properties that were unnecessary in previous theories as a result of the plasticity and kinetic theory formalisms on which quasistatic and rapid-flow theories are respectively based. Granular flows are then divided into two broad categories, the Elastic Regimes, in which the particles are locked in force chains and interact elastically over long duration contact with their neighbors and the Inertial regimes, where the particles have broken free of the force chains. The Elastic regimes can be further subdivided into the Elastic-Quasistatic regime (the old quasistatic regime) and the Elastic-Inertial regime. The Elastic-Inertial regime is the new regime observed in the landslide simulations, in which the inertially induced stresses are significant compared to the elastically induced stresses. The Inertial regime can also be sub-divided into an Inertial-Non-Collisional where the stresses scale inertially, but the particles interact through long duration contacts, and the Inertial-Collisional or rapid-flow regime. Finally, it will be shown that Stress-Controlled flows are rheologically different from Controlled-Volume flows. Physically, there is a range of dense concentrations (0.5\h0.6) in which it is possible to form force chains and thus to demonstrate elastically. But there are conditions under which force chains may or may not form at a given average concentration. (In other words it is possible for the material to exhibit two different states at the same concentration.) By forcing the material to support an applied loads across force chains, Stress-Controlled flows generally behave elastically through this range of concentrations under the same conditions where Controlled-Volume flows behave inertially.

Author

Elastic Properties; Flow Theory; Computerized Simulation; Coefficient of Friction; Landslides

20050201834 Concordia Univ., Montreal, Quebec, Canada

Possible Crater-Floor Thermokarst in Utopia Planitia, Mars

Soare, Richard J.; Tseung, J. M. Wan Bun; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Pits, depressions and collapse features that are consistent with the morphology of terrestrial thermokarst have been identified in five mid- to high-latitudinal areas of Mars: 1. the circum-Chryse outflow channels [1][2][3][4]; 2. Chryse Planitia itself [5][6]; 3. the volcanic fields surrounding Olympus Mons and those to the west of Elysium Mons [7]; 4. the southern margin of the Vastitas Borealis formation [8]; and, 5. two of the great northern plains - Acidalia [9] and - Utopia Planitiae [10][11][12]. These are areas where water may have been present in the past and where near-surface ground ice could be extant today. We focus on a region of Utopia Planitia where pits, depressions and collapse features are highly concentrated (approx.40deg - approx.50degN and approx.260deg - approx.281degW) in order to evaluate the plausibility of a thermokarst formation hypothesis.

Derived from text

Craters; Mars Surface; Morphology; Mars Volcanoes; Collapse

20050201835 Hokkaido Univ., Sapporo, Japan

Ejecta Flow from 3-D Granular Flow Models

Wada, S. K.; Barnouin-Jha O. S.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Currently two main models are considered viable for the emplacement of fluidized ejecta: (1) initial ballistic emplacement of ejecta and subsequent flow primarily as a consequence of volatile presence [1, 2, 3, 4], and (2) impact derived winds, which

entrain, saltate and eventually emplace ejecta as a gravity current [5]. Some authors have proposed that a mixture of both models could also explain the morphological features seen. However, no study exists where a simple granular flow is used to explain fluidized ejecta. Yet there are many instances where granular flows can explain a wide range of flow features seen at terrestrial rock avalanches and falls [6, 7, 8, 9]. These include the formation of multiple ramparts and circumferential lineaments, as well as the incredible long runout of so called long-runout landslides. In this effort, we explore the circumstances under which granular ejecta may generate a flow during emplacement using a 3-D granular flow model. In this model, each grain of ejecta is treated as a distinct element [10]. Using this distinct element model (DEM), we investigate the process of ballistic sedimentation and subsequent flow without invoking either water or atmosphere. Thus, even though ejecta flows are seen lacking on the Moon and Mercury (suggesting that granular flows may not be viable on Mars), such an investigation provides at a minimum insights into the mechanics of interaction between ejecta in the thickest portions of the curtain and a target surface. Such information did not exist before, and is particularly important for determining how much kinetic energy of the ejecta goes into creating an advancing flow. Eventually coupled fluid flow and 3-D DEM models will also be available to determine the transport and emplacement of ejecta by winds created during an impact in the presence of an atmosphere.

Author

Ejecta; Fluid Flow; Wind Effects; Structural Properties (Geology); Morphology; Landslides

20050201855 Geo Eco Arc Research, Aquasco, MD, USA

The Role of the Atmosphere and Target Volatiles in the Emplacement of the Chicxulub Ejecta Blanket and Analogies with Martian Impact Ejecta

Pope, K. O.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 90-91; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

The Chicxulub impact into the volatile-rich Yucatan Peninsula produced a 200 km diameter crater and one of the best preserved ejecta blankets on Earth. Emplacement of ejecta south of the impact site occurred largely on an emergent karst land surface, whereas material ejected to the north, east, and west mostly landed in deep water of the Gulf of Mexico or Caribbean Sea. Thus, preserved ejecta deposits in the south provide the opportunity to study emplacement processes that may be analogous to those found on Mars.

Derived from text

Craters; Deposits; Ejecta; Earth Surface; Analogies

20050201857 Academy of Sciences (USSR), Moscow, USSR

Fluidized Ejecta of Martian Lobate Craters and Composition of the Highland Rocks

Kochemasov, G. G.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

A specific martian feature - lobate ejecta blankets around craters extending up to 1.5 times of a crater diameter (much wider than continuous ejecta of lunar - 0.6-0.7 diameter, and mercurian - 0.4-0.5 diameter, craters) is usually attributed for the frozen water in the martian crust. This water could fluidize under impact excavated material and make it flow like liquid. The geomorphological evidences show that the ejected material really behaves like liquid (resembles the heavy clay liquid for drilling), flows and skirts obstacles but usually does not show any significant settling. One would expect this settling for water rich material. Could it have, along with some water, compositional peculiarities? It seems that after Gamma-spectrometry of 'Odyssey' and two landers - 'Spirit' and 'Opportunity' analyses one can say that a 'peculiar rock' is marked out. 'Odyssey' show rather low silica over highlands (20-21% [1]) and, that is especially interesting, over high standing Tharsis bulge (18-20%) [1]. Low Fe signifies that this lowering in silica is not due to the basic rocks which were postulated in 'entirely basaltic Mars' model (the martian meteorites as a proof). MGS gravity data [2] have clearly shown that the martian southern highlands are composed of 'light' (not dense) lithologies, much less dense than the northern lowland Fe-basalts, otherwise relatively flat even gravity signals over two hemispheres were not possible [2]. The previous global albedo data also have shown that the southern highlands are much lighter (average albedo 0.25) than the dark northern lowlands (0.15)[3] hinting at different rocks. Very long lobate formations around huge Tharsis volcanoes also require very low viscosity lavas. Density of martian soils on surface and to a depth of about 10 m according to various geophysical methods (radar, polarimetry, IR, 'Viking' data) is lower than that of the Moon and is lower for light areas than for dark ones [3]. Now this 'whitish' low density material is partly characterized on Meridiani Planum by 'Opportunity' [4] - it is salt: sulfates, chlorides, bromides covering and penetrating layered sedimentary (mainly eolian?) rocks. The salts are discovered in craters and, as it shown by an artificial very shallow impact crater (after fall of the 'Opportunity' s heat shield), under thin cover of eolian reddish Fe-rich drifts. The salts cover large areas on Meridiani Planum. Their most probable origin is due to widespread hydrothermal activity, vents

being craters and deep cracks (faults) draining depths of the highland crust. So, salts are not just a thin veneer but a significant constituent part of the highland crust. That is why Tharsis is surprisingly low in Si. Silicates are partially replaced by salts (low density substance), this is required by necessity to diminish the mean density of highly standing tectonic blocks of Mars - a rotating planetary body that obeys the physical law of keeping equal angular momenta of hypsometrically different tectonic blocks. The aqueous salts with constituent water not only diminish a mean rock density and explain the presence of hydrogen (H₂O) at the equatorial zones in 'Odyssey' data but also bring down the melting temperature of impacted rocks making ejecta easily flowing (like a dough for pan-cakes).

Author

Ejecta; Mars Craters; Structural Properties (Geology); Tectonics; Planetary Geology; Planetary Crusts; Liquid Flow; Mars Surface; Rocks

20050201918 Michigan Univ., Ann Arbor, MI, USA, Southwest Research Inst., San Antonio, TX, USA

Processes of Equatorial Thermal Structure: An Analysis of Galileo Temperature Profile with 3-D Model

Majeed, T.; Waite, J. H., Jr.; Bougher, S. W.; Gladstone, G. R.; [2005]; 23 pp.; In English

Contract(s)/Grant(s): NAG5-11031; NSF AST-0300005; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Jupiter Thermosphere General Circulation Model (JTGCM) calculates the global dynamical structure of Jupiter's thermosphere self-consistently with its global thermal structure and composition. The main heat source that drives the thermospheric flow is high-latitude Joule heating. A secondary source of heating is the auroral process of particle precipitation. Global simulations of Jovian thermospheric dynamics indicate strong neutral outflows from the auroral ovals with velocities up to approximately 2 kilometers per second and subsequent convergence and downwelling at the Jovian equator. Such circulation is shown to be an important process for transporting significant amounts of auroral energy to equatorial latitudes and for regulating the global heat budget in a manner consistent with the high thermospheric temperatures observed by the Galileo probe. Adiabatic compression of the neutral atmosphere resulting from downward motion is an important source of equatorial heating (less than 0.06 microbar). The adiabatic heating continues to dominate between 0.06 and 0.2 microbar, but with an addition of comparable heating due to horizontal advection induced by the meridional flow. Thermal conduction plays an important role in transporting heat down to lower altitudes (greater than 0.2 microbar) where it is balanced by the cooling associated with the wind transport processes. Interestingly, we find that radiative cooling caused by H₃(+), CH₄, and C₂H₂ emissions does not play a significant role in interpreting the Galileo temperature profile.

Author

Three Dimensional Models; Equators; Temperature Profiles; Thermosphere; Galileo Probe

20050202031 Texas Univ., San Antonio, TX, USA

Experimental Reproduction of Olivine rich Type-I Chondrules

Smith, Robert K.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 19-1 - 19-7; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A02](#), Hardcopy

Ordinary chondritic meteorites are an abundant type of stony meteorite characterized by the presence of chondrules. Chondrules are small spheres consisting of silicate, metal, and sulfide minerals that experienced melting in the nebula before incorporation into chondritic meteorite parent bodies. Therefore, chondrules record a variety of processes that occurred in the early solar nebula. Two common types of unequilibrated chondrules with porphyritic textures include FeO-poor (type I) and FeO-rich (type II) each subdivided into an A (SiO₂-poor) and B (SiO₂-rich) series. Type IA chondrules include those with high proportions of olivine phenocrysts (>80% olivine) and type IB chondrules include those with high proportions of pyroxene phenocrysts (>20% olivine). An intermediate composition, type IAB chondrules include those chondrules in which the proportion of olivine phenocrysts is between 20-80%. We conducted high-temperature laboratory experiments (melting at 1550 C) to produce type I chondrules from average unequilibrated ordinary chondrite (UOC) material mixed with small amounts of additional olivine. The experiments were conducted by adding forsteritic rich olivine (San Carlos olivine, Fo 91) to UOC material (GRO 95544) in a 30/70 ratio, respectively. Results of these high temperature experiments suggest that we have replicated type IA chondrule textures and compositions with dynamic crystallization experiments in which a heterogeneous mixture of UOC (GRO 95544) and olivine (San Carlos olivine) were melted at 1550 C for 1 hr. and cooled at 5-1000 C/hr using graphite crucibles in evacuated silica tubes to provide a reducing environment.

Author

Chondrule; Meteorites; Meteoritic Composition; Iron Oxides; Silicon Dioxide; Petrology; Pyroxenes

20050202045 Lunar and Planetary Inst., Houston, TX, USA

Workshop on Oxygen in Asteroids and Meteorites

[2005]; ISSN 0161-5297; 39 pp.; In English; Workshop on Asteroids and Meteorites, 2-3 Jun. 2005, Flagstaff, AZ, USA; See also 20050202046 - 20050202074

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1267; Copyright; Avail: CASI; [A03](#), Hardcopy

Contents include the following: Constraints on the detection of solar nebula's oxidation state through asteroid observation. Oxidation/Reduction Processes in Primitive Achondrites. Low-Temperature Chemical Processing on Asteroids. On the Formation Location of Asteroids and Meteorites. The Spectral Properties of Angritic Basalts. Correlation Between Chemical and Oxygen Isotopic Compositions in Chondrites. Effect of In-Situ Aqueous Alteration on Thermal Model Heat Budgets. Oxidation-Reduction in Meteorites: The Case of High-Ni Irons. Ureilite Atmospherics: Coming up for Air on a Parent Body. High Temperature Effects Including Oxygen Fugacity, in Pre-Planetary and Planetary Meteorites and Asteroids. Oxygen Isotopic Variation of Asteroidal Materials. High-Temperature Chemical Processing on Asteroids: An Oxygen Isotope Perspective. Oxygen Isotopes and Origin of Opaque Assemblages from the Ningqiang Carbonaceous Chondrite. Water Distribution in the Asteroid Belt. Comparative Planetary Mineralogy: V Systematics in Planetary Pyroxenes and fo 2 Estimates for Basalts from Vesta.

CASI

Asteroids; Oxidation; Carbonaceous Chondrites; Chemical Composition; Oxygen Isotopes

20050202049 Open Univ., Milton Keynes, UK

Determining the Effects of Aqueous Alteration on the Distribution of Oxygen Isotopes in Carbonaceous Chondrites

Morris, A. A.; Baker, L.; Franchi, I. A.; Wright, I. P.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Carbonaceous chondrites play a key role in determining the history of the early Solar System; a knowledge of the oxygen isotope variation within these materials will not only help in our understanding of the origin and evolution of those meteorites, but also the early Solar System reservoirs from which they formed [1]. However, several problems present themselves when trying to interpret early Solar System history. One is identifying the isotopic signature of oxygen from specific component compounds in a complex mixture of materials that existed in the solar nebula, and deconvoluting this from signatures developed during parent body processing (e.g. aqueous alteration, thermal metamorphism). Only then is it possible to develop an understanding of the nature and conditions of these secondary processes.

Derived from text

Carbonaceous Chondrites; Oxygen Isotopes; Reservoirs; Metamorphism (Geology); Planetary Evolution

20050202051 Rutgers - The State Univ., Piscataway, NJ, USA

Ureilite Atmospherics: Coming up for 'Air' on a Parent Body

Delaney, Jeremy S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: The ureilite group is unusual. Petrographically, ureilites appear to be samples of a coherent suite that differentiated on a single parent body. The oxygen isotope ratios of the ureilites vary along a mass-independent fractionation (MIF) trend rather than the mass-dependent trend typical of most differentiated asteroids sample suites. The individual ureilites cannot be linked to one another by mass dependent fractionation of oxygen isotopes. Isolated lithic clasts in an individual polymict ureilite cannot be linked to a common process, by mass-dependent fractionation yet they are, by definition, samples of the same parent body. The MIF trend for oxygen is as fundamental property of ureilites, as the intense redox exchange products visible in all samples. While mixing of heterogeneous precursors might explain the variation of ureilite oxygen isotope ratios, it is implausible that such variation would survive the very high temperature processes implicit in ureilite petrography.

Derived from text

Ureilites; Asteroids; Isotope Ratios; Oxidation-Reduction Reactions; Petrography

20050202058 New Mexico Univ., Albuquerque, NM, USA

Eu Valence Oxyparameter in Pyroxenes. Effects of Pyroxene Composition- Crystallization Histories-Crystallization Kinetics and a Comparison Between Lunar Basalts and Eucrites

Shearer, C. K.; Papike, J. J.; Karner, J. M.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Lunar basalts and eucrites are thought to crystallize at fO_2 conditions below IW. The FeO contents of these basalts have been interpreted as indicating that both basalts crystallized at IW-1. To better understand potential subtle differences among lunar basalts and between lunar basalts and eucrites, we are investigating the behavior of multivalent cations (Eu, V) in pyroxenes. The behavior of Eu in martian basalts has been demonstrated to be an effective measure of $f(\text{sub } O_2)$. Here, we compare the Eu/Eu* in pyroxenes from the more reducing environments of the Moon and the HED parent body, evaluate the dependence of Eu/Eu* on pyroxene composition-crystallization sequence-crystallization kinetics and contrast the relationship between Eu/Eu* and V.

Author

Europium; Pyroxenes; Crystallization; Kinetics; Meteoritic Composition; Basalt; Moon; Valence

20050202061 Imperial Coll. of Science, Technology and Medicine, London, UK

Low-Temperature Chemical Processing on Asteroids

Bland, P. A.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

A means of reconciling geochemical and petrographic studies in CCs involves considering the length-scale over which aqueous metasomatism took place: element mobility occurred, but in C3s it was restricted to zones within approx. 100-200 m of anhydrous chondrules. In C2s and C1s fluid transport did not occur over distances ≥ 100 m. Oxygen isotope data can also be interpreted as consistent with closed system, isochemical alteration [21]. Numerical modelling of asteroidal alteration suggests flow of pore water may have been limited in parent bodies ≤ 80 km diameter [23]. The available data therefore appear to be consistent with an environment where fluid flow was minimal, alteration was isochemical, and CC parent bodies were not more than a few 10 s km in diameter.

Author

Meteoritic Composition; Asteroids; Geochemistry; Fluid Flow; Chondrule; Metamorphism (Geology)

20050202063 Arizona State Univ., Tempe, AZ, USA

Oxygen Isotopes and Origin of Opaque Assemblages from the Ningqiang Carbonaceous Chondrite

Guan, Yun-Bin; Hsu, Wei-Biao; Hua, Xin; Leshin, Laurie A.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Opaque assemblages (OAs), also called Fremdlinges, are complex objects that normally contain Fe-Ni metals, magnetite, sulfides, phosphates, silicates, Pt-metal nuggets and their oxides. OAs occur in Ca-Al-rich inclusions (CAIs), chondrules, and matrix of carbonaceous chondrites [1-10]. The unique and complex mineral components of OAs indicate that they formed at a wide temperature range and under highly variable redox conditions [1]. Oxygen isotopes of OAs, unavailable until now, can help us understand the origin of these objects and provide us insights about the early processes in solar nebula or on asteroid bodies. The OAs (approx. 100 to approx. 350 microns in sizes) from the Ningqiang carbonaceous chondrite were observed in its chondrules and matrix. The morphology, texture, and mineralogy of these OAs closely resemble those of CAI OAs [10]. Briefly, they appear as round to oblate spheroids. Major mineral phases are magnetite, Ni-rich metal, troilite/pentlandite, and whitlockite. Minor phases include silicates (olivine and pyroxene) and mesostasis (mixture of silicates and phosphates). Os-Pt-rich Fe-Ni grains (approx. 150 nm in sizes) are rare and appear only in magnetite.

Derived from text

Oxygen Isotopes; Carbonaceous Chondrites; Meteoritic Composition; Oxidation-Reduction Reactions; Pyroxenes; Silicates; Morphology; Mineralogy; Asteroids

20050202071 Portland State Univ., OR, USA

Relict Olivine, Chondrule Recycling, and Evolution of Oxygen Reservoirs

Ruzicka, A.; Hiyagon, H.; Floss, C.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: Using SIMS techniques we have analyzed oxygen isotopes and trace elements in relict olivine grains, together with co-existing overgrowths and normal olivine, within chondrules of the Chainpur (LL3.4) and Sahara 97210 ('Sahara', LL3.2) chondrites. As relict olivine grains predate the formation of host chondrules, they provide an opportunity to study how chondrule components evolved.

Author

Olivine; Chondrule; Recycling; Meteoritic Composition

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20050199689 California Inst. of Tech., Pasadena, CA, USA

Global Radiative Effect of Particulate Black Carbon

Seinfeld, J. H.; Chung, S. H.; May 2005; 80 pp.; In English

Contract(s)/Grant(s): CARB-02-322

Report No.(s): PB2005-107590; No Copyright; Avail: CASI; [A05](#), Hardcopy

The primary objective of this research was to provide the Air Resources Board (ARB) with state-of-the-science global radiative forcing estimates for black carbon and other aerosols in conjunction/comparison with other greenhouse gases. These estimates, both at top of the atmosphere and at the surface, were obtained over 25-year intervals for 2000, 2025, 2050, 2075, 2100, based on Intergovernmental Panel on Climate Change (IPCC) estimates of emissions over the next century. Carbon dioxide (CO₂) and other greenhouse gases and black carbon (BC) particulate matter influence global climate. With reference to potential measures to abate the effect of California emissions of greenhouse gases and particulate matter on climate, it is necessary to determine the current magnitude of that effect relative to the estimated full global impact. The present report focuses on global climatic effects of BC, and based on an estimate of the percentage of global BC emissions attributable to California, extrapolates that effect to California emissions alone. Since black carbon particulate matter tends to mix with other particulate material in the atmosphere, the radiative effect of BC needs to be considered in conjunction with that of other aerosol species, namely, sulfate, nitrate, ammonium, and primary organic aerosol; the manner in which BC is mixed with other particulate species is quite important to its radiative impact. In the current study, we have estimated present-day BC emissions from California by scaling the recent BC inventory of Bond et al. (2004) to California on the basis of population.

NTIS

Carbon; Climate Change; Climatology; Particulates

20050200898 Naval Postgraduate School, Monterey, CA USA

A Complex Adaptive System Approach to Forecasting Hurricane Tracks

Lear, Matthew R.; Jun. 2005; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435521; No Copyright; Avail: Defense Technical Information Center (DTIC)

Forecast hurricane tracks using a multi-model ensemble that consists of linearly combining the individual model forecasts have greatly reduced the average forecast errors when compared to individual dynamic model forecast errors. In this experiment, a multi-agent system, the Tropical Agent Forecaster (TAF), is created to fashion a 'smart' ensemble forecast. The TAF uses autonomous agents to assess the historical performance of individual models and model combinations, called predictors, and weights them based on their average error compared to the best track information. Agents continually monitor themselves and determine which predictors, for the life of the storm, perform the best in terms of the distance between forecast and best-track positions. A TAF forecast is developed using a linear combination of the highest weighted predictors. When applied to the 2004 Atlantic hurricane season, the TAF system, with a requirement to contain a minimum of three predictors, consistently outperformed the consensus forecast (CONU) at 72 and 96 hours for a homogeneous data set, although the differences were not statistically significant. But at 120 hours, the TAF system significantly decreased the average forecast errors when compared to the CONU. The multi-agent system (MAS) approach opens the door for statistically significant forecast improvement. This thesis was submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Science.

DTIC

Artificial Intelligence; Complex Systems; Errors; Forecasting; Hurricanes; Prediction Analysis Techniques; Tracking (Position)

20050200899 Naval Postgraduate School, Monterey, CA USA

Forecasting Hurricane Tracks Using a Complex Adaptive System

Lear, Matthew R.; Jun. 2005; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435522; No Copyright; Avail: Defense Technical Information Center (DTIC)

Forecast hurricane tracks using a multi-model ensemble that consists of linearly combining the individual model forecasts have greatly reduced the average forecast errors when compared to individual dynamic model forecast errors. In this experiment, a multi-agent system, the Tropical Agent Forecaster (TAF), is created to fashion a 'smart' ensemble forecast. The

TAF uses autonomous agents to assess the historical performance of individual models and model combinations, called predictors, and weights them based on their average error compared to the best track information. Agents continually monitor themselves and determine which predictors, for the life of the storm, perform the best in terms of the distance between forecast and best-track positions. A TAF forecast is developed using a linear combination of the highest weighted predictors. When applied to the 2004 Atlantic hurricane season, the TAF system, with a requirement to contain a minimum of three predictors, consistently outperformed the consensus forecast (CONU) at 72 and 96 hours for a homogeneous data set, although the differences were not statistically significant. But at 120 hours, the TAF system significantly decreased the average forecast errors when compared to the CONU. The multi-agent system (MAS) approach opens the door for statistically significant forecast improvement. This thesis was submitted in partial fulfillment of the requirements for the degree of Master of Science in Meteorology.

DTIC

Artificial Intelligence; Complex Systems; Errors; Forecasting; Hurricanes; Prediction Analysis Techniques; Tracking (Position)

20050200934 Naval Postgraduate School, Monterey, CA USA

Network Shortest Path Application for Optimum Track Ship Routing

Montes, Anel A.; Jun. 2005; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435601; No Copyright; Avail: Defense Technical Information Center (DTIC)

The USA Navy Meteorology and Oceanography (METOC) community routes ships for weather evasion using advanced meteorological modeling and satellite data, but lacks a tool to enable fewer ship routers to make better routing decisions faster. Limited resources and rising costs are affecting the frequency and duration of current naval operations. The Commander, Naval Meteorology and Oceanography Command, has ordered the community to find efficiencies and automation possibilities to meet lower manning levels, reduce waste, and increase savings. Outside of the Navy, Ocean Systems Incorporated in Alameda, California, developed the Ship Tracking and Routing System (STARS) software package to calculate optimum sea routes based on weather model data. However, METOC ship routers are reluctant to adopt this complex software. To help solve this problem, the author modeled Optimum Track Ship Routing (OTSR) for U.S. Navy warships using a network graph of the Western Pacific Ocean. A binary heap version of Dijkstra's algorithm determines the optimum route given model generated wind and seas input. To objectively assess the model, test cases using recent model data and historical case comparisons were run. The results of these tests show that the author has successfully devised a network ship routing model that solves optimal path problems using a modified version of Dijkstra's shortest path algorithm and a basic ship response function. The model avoids adverse weather and solves the least-time path to a destination. It calculates useful time, distance, and fuel consumption metrics to quantify routing decisions. The model also demonstrates that manual routing techniques involving numerous calculations and chart plotting can be automated and solutions generated in milliseconds. He has identified how the results could be used by ship routing personnel to assist in analyzing alternatives and aiding ship routing decisions.

DTIC

Computer Programs; Conditions; Decision Making; Hazards; Optimization; Routes; Ships

20050200962 Naval Postgraduate School, Monterey, CA USA

Predictability Associated with the Downstream Impact of the Extratropical Transition of Tropical Cyclone

Reeves, Justin M.; Jun. 2005; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435647; No Copyright; Avail: Defense Technical Information Center (DTIC)

Since an extratropical transition (ET) of a decaying tropical cyclone (TC) often results in a fast-moving, rapidly-developing extratropical cyclone and amplification of synoptic-scale systems far downstream, proper forecasting of ET events is critical to forecast accuracy over large ocean regions. Past studies have linked forecast accuracy to the phasing of a decaying TC with favorable midlatitudes conditions. Because ET events are sensitive to the analyzed initial conditions, this phasing is examined using 11 member ensemble predictions available four times daily from the National Centers for Environmental Prediction, which were combined into a single 44 member ensemble based on a common forecast verification time. Recurring ET patterns within the 44 member ensemble were objectively identified using a combination of EOF and cluster analysis. Ensemble spread first appears near the point where the TC moves into the midlatitudes and then propagates downstream. Although ensemble spread in the forecast fields was large at extended forecast intervals, the ensemble spread, and the number of ET patterns identified in successive EPS predictions, decreased as the ET process became better defined. Within 48 hours of the ET event, the ensemble prediction system properly identified the ET pattern with a minimum ensemble spread. Similar

to Klein et al. (2002), the shifts in the initial position of the TC and the subsequent dynamical coupling can explain differences between weak and strong ET reintensifications.

DTIC

Cyclones; Forecasting; Predictions; Tropical Storms

20050201000 Woods Hole Oceanographic Inst., MA USA

Stratus Ocean Reference Station (20 deg S, 85 deg W), Mooring Recovery and Deployment Cruise, R/V Ron Brown Cruise 04-11, December 5 - December 24, 2004

Colbo, Keir; Weller, Robert; Lord, Jeff; Fairall, Chris; Bradley, Frank; Wolfe, Dan; Serpetzoglou, Efthymios; Tomlinson, Jason; Tisandie, Alvaro G.; Bustos, Juan F.; May 2005; 130 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NA17RJ1225

Report No.(s): AD-A435722; WHOI-2005-06; UOP-2005-02; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Ocean Reference Station at 20 degs S, 85 degs W under the stratus clouds west of northern Chile and Peru is being maintained to provide ongoing, climate-quality records of surface meteorology, of air-sea fluxes of heat, freshwater, and momentum, and of upper ocean temperature, salinity, and velocity variability. The Stratus Ocean Reference Station (ORS Stratus) is supported by the National Oceanic and Atmospheric Administration's (NOAA) Climate Observation Program. It is recovered and redeployed annually, with cruises that have come between October and December. During the December 2004 cruise of NOAA's R/V Ronald H. Brown to the ORS Stratus site, the primary activities were the recovery of the WHOI surface mooring that had been deployed in November 2003, the deployment of a new WHOI surface mooring at that site, the in-situ calibration of the buoy meteorological sensors by comparison with instrumentation put on board by staff of the NOAA Environmental Technology Laboratory (ETL), and observations of the stratus clouds and lower atmosphere by NOAA ETL and Jason Tomlinson from Texas A&M. The ORS Stratus buoys are equipped with two Improved Meteorological systems, which provide surface wind speed and direction, air temperature, relative humidity, barometric pressure, incoming shortwave radiation, incoming longwave radiation, precipitation rate, and sea surface temperature. The IMET data are made available in near real time using satellite telemetry. The mooring line carries instruments to measure ocean salinity, temperature, and currents. The ETL instrumentation used during the 2004 cruise included cloud radar, radiosonde balloons, and sensors for mean and turbulent surface meteorology. The atmospheric observations also benefited from the C-Band radar mounted on the R/V Ronald H. Brown.

DTIC

Deployment; Meteorological Parameters; Mooring; Oceanographic Parameters; Oceanography; Oceans

20050201949 Science Applications, Inc., Vienna, VA, USA

Road Weather Information System Environmental Sensor Station Siting Guidelines

Manfredi, J.; Walters, T.; Wilke, G.; Osborne, L.; Hart, R.; Apr. 2005; 56 pp.; In English

Contract(s)/Grant(s): DTFH61-01-C-00180

Report No.(s): PB2005-108450; No Copyright; Avail: CASI; [A04](#), Hardcopy

A Road Weather Information System (RWIS) consists of the hardware, software, and communications interfaces necessary to collect and transfer road weather observations from or near the roadway to a display device at the user's location. While the original purpose of RWIS was to address winter weather conditions, applications have been developed to detect and monitor a variety of road weather conditions impacting road operations and maintenance. Most RWISs now consist of several meteorological and pavement condition monitoring stations strategically located near highways to help transportation managers make more informed operational decisions. An Environmental Sensor Station (ESS) is considered the 'collection' component of an RWIS and consists of the equipment and sensors installed within or along a roadway. This document provides guidelines for siting an RWIS ESS and its associated environmental and pavement sensors. These guidelines are intended to help establish uniformity in siting ESSs and to improve the usefulness of road weather information derived from ESS observations.

NTIS

Information Systems; Roads

20050201962 Lawrence Livermore National Lab., Livermore, CA USA

Effects of Domain Size and Numerical Resolution on the Simulation of Shallow Cumulus Convection

Stevens, D.; Mar. 26, 2002; 10 pp.; In English

Report No.(s): DE2005-15013315; UCRL-JC-145931-REV-1; No Copyright; Avail: Department of Energy Information Bridge

This talk presents three-dimensional numerical simulations of oceanic trade cumulus clouds underlying stratocumulus clouds. It is based on a Global Energy and Water Experiment (GEWEX) Cloud System Study (GCSS) model intercomparison that is loosely based on observed conditions during the Atlantic Trade Cumulus Experiment (ATEX). It is motivated by the importance of this cloud type to global cloud radiative forcing, and its role as a feeder system for deep convection in the tropics. This study focuses on the sensitivity of the modeled cloud field to the domain size and the grid spacing by studying two sequences of simulations with different domain widths of 6.4 and 20.2 kilometers. Each sequence contains simulations where the horizontal mesh spacing ranged from 10 to 80 meters and the vertical from 5 to 40 m. The combination of large domain size and small grid resolution (up to 2.5 billion grid-cells) provides an unprecedented perspective on this type of convection. This is in contrast to Prior LES simulations which have often used domains a few kilometers wide. The larger domain size considered here is comparable to the grid resolution of a typical current mesoscale model (a similar resolution will soon be achieved in some global weather forecast models), and can better represent the potential horizontal variability achievable within a mesoscale grid cell.

NTIS

Convection; Cumulus Clouds; Simulation

20050201963 Lawrence Livermore National Lab., Livermore, CA USA

Analysis of Forcing Response, and Feedbacks in a Paleoclimate Modeling Experiment

Taylor, K. E.; Hewitt, C. D.; Braconnot, P.; Broccoli, A. J.; Doutriaux, C.; Apr. 11, 2005; 12 pp.; In English

Report No.(s): DE2005-15013305; UCRL-JC-143363; No Copyright; Avail: Department of Energy Information Bridge

It is often argued that paleoclimate studies are necessary to determine whether climate models and their predictions of future climate change can be trusted. An overall measure of the sensitivity of global mean surface temperature to a given radiative perturbation is provided by the global climate sensitivity parameter. In climate model experiments, this parameter appears to be moderately independent of the cause of the perturbation, but it may differ from one model to the next by as much as a factor of three. Moreover, there are some scientists who claim that all models are much more sensitive than the climate system itself. Thus it would be valuable to determine which models (if any) are consistent with the paleoclimate record and what factors are responsible for model differences in sensitivity. In an analysis of the Paleoclimate Modeling Intercomparison Project (PMIP) simulations of the Last Glacial Maximum (LGM) of 21,000 years ago, we have calculated how the 'forcing' and feedbacks determine the climatic response. In the PMIP context, the ice sheet distribution is prescribed and the resulting increase in planetary albedo is the most important 'forcing' factor. Also important are radiation perturbations induced by changes in atmospheric CO₂ concentration. Here we describe a new, approximate method for estimating the strength of forcing and feedback factors from commonly archived model output. We also summarize preliminary results from the PMIP experiment, which show that differences in forcing and to a lesser extent differences in feedbacks can explain differences in surface temperature response.

NTIS

Climate Models; Feedback; Paleoclimatology

20050201998 Lawrence Livermore National Lab., Livermore, CA USA

High-Resolution Global Climate Simulation

Duffy, P. B.; Jan. 23, 2001; 14 pp.; In English

Report No.(s): DE2005-15013383; UCRL-ID-146897; No Copyright; Avail: Department of Energy Information Bridge

One approach to simulating regional-scale climate, and the societal impacts of climate change, is to run global climate models at much finer spatial resolutions. This has not been attempted previously because the computational demands have been prohibitive. By taking advantage of ASCI-scale computer resources at DOE/LLNL, we have successfully performed global climate simulations at much finer spatial resolutions than ever attempted before. As expected, we found that these high-resolution simulations produce much more realistic regional climates than coarse-resolution models do. A major reason for this is better representation of topography, which strongly influences surface temperature and precipitation. We also found that the results of fine-resolution simulations are superior to those of coarse-resolution simulations even on scales that are resolved in the coarse-resolution simulations.

NTIS

Climate Change; Climatology; Computerized Simulation; High Resolution; Simulation

20050203653 Colorado State Univ., Fort Collins, CO, USA

Comparison of Cloud Resolving Model Simulations to Remote Sensing Data

Randall, David A.; Eitzen, Zachary; August 10, 2005; 5 pp.; In English

Contract(s)/Grant(s): NAG1-02008; No Copyright; Avail: CASI; [A01](#), Hardcopy

The purpose of this research was to evaluate the ability of a cloud-resolving model (CRM) to simulate the dynamical, radiative, and microphysical properties of deep convective cloud objects identified using CERES (Clouds and the Earth's Radiant Energy System) on board the Tropical Rainfall Measuring Mission (TRMM) satellite platform, for many cases. A deep convective cloud object is a contiguous region that is composed of satellite footprints that fulfill the following selection criteria: 100% cloud fraction, cloud optical depth ≥ 10 , and a cloud top height of at least 10 km. Selection criteria have also been formed for different types of boundary-layer clouds, as described in Xu et al. (2005). The purpose of the cloud object approach is to identify specific areas of where the cloud properties simulated by the CRM systematically differ from the observed cloud properties. Where these systematic differences exist, concrete steps can be made to improve the CRM's simulation of an entire class of clouds, rather than by tuning the model to correctly simulate a single case study, as is often done. Additional information regarding detailed approaches and findings are presented.

Derived from text

Atmospheric Models; Cloud Physics; Remote Sensing; Cumulonimbus Clouds; Computerized Simulation; Satellite Imagery

20050203795 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: May 2005

May 2005; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains following observation data. Full Disk Earth's Cloud, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Out-going Longwave Radiation), Solar Radiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR Image Data Catalog, (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. Although this user's guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files which are contained in the CD-ROM, Please read the document files.

Derived from text

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Meteorological Satellites; Japan

20050203836 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Means, Variability and Trends of Precipitation in the Global Climate as Determined by the 25-year GEWEWGPCP Data Set

Adler, R. F.; Gu, G.; Curtis, S.; Huffman, G. J.; [2004]; 1 pp.; In English; Workshop on Trends in Global Water Cycle Variables to Support IPCC Assessment, 3-5 Nov. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The Global Precipitation Climatology Project (GPCP) 25-year precipitation data set is used as a basis to evaluate the mean state, variability and trends (or inter-decadal changes) of global and regional scales of precipitation. The uncertainties of these characteristics of the data set are evaluated by examination of other, parallel data sets and examination of shorter periods with higher quality data (e.g., TRMM). The global and regional means are assessed for uncertainty by comparing with other satellite and gauge data sets, both globally and regionally. The GPCP global mean of 2.6 mday is divided into values of ocean and land and major latitude bands (Tropics, mid-latitudes, etc.). Seasonal variations globally and by region are shown and uncertainties estimated. The variability of precipitation year-to-year is shown to be related to ENSO variations and volcanoes and is evaluated in relation to the overall lack of a significant global trend. The GPCP data set necessarily has a heterogeneous time series of input data sources, so part of the assessment described above is to test the initial results for potential influence by major data boundaries in the record.

Author

Climatology; Annual Variations; Precipitation (Meteorology); Time Series Analysis; Periodic Variations; Estimating

20050203837 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A New Approach to using a Cloud-Resolving Model to Study the Interactions between Clouds, Precipitation and Aerosols

Tao, Wei-Kuo; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Numerical cloud models, which are based the non-hydrostatic equations of motion, have been extensively applied to cloud-scale and mesoscale processes during the past four decades. Because cloud-scale dynamics are treated explicitly, uncertainties stemming from convection that have to be parameterized in (hydrostatic) large-scale models are obviated, or at least mitigated, in cloud models. Global models will use the non-hydrostatic framework when their horizontal resolution becomes about 10 km, the theoretical limit for the hydrostatic approximation. This juncture will be reached one to two decades from now. Over the past generation, voluminous datasets on atmospheric convection have been accumulated from radar, instrumented aircraft, satellites, and rawinsonde measurements in field campaigns, enabling the detailed evaluation of models. Improved numerical methods have resulted in more accurate and efficient dynamical cores in models. Improvements have been made in the parameterizations of microphysical processes, radiation, boundary-layer effects, and turbulence; however, microphysical parameterizations remain a major source of uncertainty in all classes of atmospheric models. In recent years, exponentially increasing computer power has extended cloud-resolving-model integrations from hours to months, the number of computational grid points from less than a thousand to close to ten million. Three-dimensional models are now more prevalent. Much attention is devoted to precipitating cloud systems where the crucial 1-km scales are resolved in horizontal domains as large as 10,000 km in two-dimensions, and 1,000 x 1,000 square kilometers in three-dimensions. Cloud models now provide statistical information useful for developing more realistic physically-based parameterizations for climate models and numerical weather prediction models. A review of developments and applications of cloud models in the past, present and future will be presented in this talk. In particular, a new approach to using cloud-resolving models to study the interactions between clouds, precipitation and aerosols will be presented.

Author

Aerosols; Clouds (Meteorology); Precipitation (Meteorology); Atmospheric Models; Numerical Analysis

20050203964 Ohio State Univ., Columbus, OH, USA

Precipitation Modeling over the Greenland and Antarctic Ice Sheets and the Relationship to the Surface Mass Balance and Climate

Bromwich, David H.; Chen, Qui-Shi; July 25, 2005; 80 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-12407; No Copyright; Avail: CASI; [A05](#), Hardcopy

Atmospheric numerical simulation and dynamic retrieval method with atmospheric numerical analyses are used to assess the spatial and temporal variability of Antarctic precipitation for the last two decades. First, the Polar MM5 has been run over Antarctica to study the Antarctic precipitation. With a horizontal resolution of 60km, the Polar MM5 has been run for the period of July 1996 through June 1999 in a series of short-term forecasts from initial and boundary conditions provided by the ECMWF operational analyses. In comparison with climatological maps, the major features of the spatial distribution of Antarctic precipitation are well captured by the Polar MM5. Drift snow effects on redistribution of surface accumulation over Antarctica are also assessed with surface wind fields from Polar MM5 in this study. There are complex divergence and convergence patterns of drift snow transport over Antarctica, especially along the coast. It is found that areas with large drift snow transport convergence and divergence are located around escarpment areas where there is large katabatic wind acceleration. In addition, areas with large snow transport divergence are generally accompanied by areas with large snow transport convergence nearby, indicating that drift snow transport is of local importance for the redistribution of the snowfall. Derived from text

Precipitation (Meteorology); Numerical Analysis; Weather Forecasting; Boundary Conditions

48

OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20050201820 Consejo Superior de Investigaciones Cientificas, Madrid, Spain

The Influence of Water on the Cratering and Modification of Marine-Target Craters - Some Thoughts Based on Recent Field Studies and Laboratory Experiments

Ormo, Jens; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 84-85; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

The most common target for impacts on Earth is volatile-rich, i.e. seawater. Depending on magnitude, the crater may form only in the water column, hence without being preserved, or reach into the seafloor, and form what is sometimes called a

marine-target crater [1]. The effect on the crater morphology and geology may be strong if the water depth exceeds the diameter of the impactor [2], but depending on the strength of the substrate also much less water can have great influence [1,3,4].

Derived from text

Craters; Sea Water; Morphology; Geology; Ocean Bottom; Cratering; Impactors

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20050199469 NASA Glenn Research Center, Cleveland, OH, USA, National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Dynamic Light Scattering Developed to Look Through the Eye's Window Into the Body

Stauber, Laurel J.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Microgravity researcher Dr. Rafat R. Ansari, from the NASA Glenn Research Center, has found that the eye operates much like a camera and is the 'window to the body.' The eye contains transparent tissue through which light passes, providing us a view of what's going on inside. These transparent tissues represent nearly every tissue type that exists throughout the body. With the correlations and comparisons of these tissues done at Glenn, we hope to improve doctors' ability to diagnose diseases at much earlier stages. The medical community will be able to look noninvasively and quantitatively into a patient's eyes to detect disease before symptoms appear. Since the eye is easily accessed by light, the optical technologies created at Glenn can be used to evaluate its structure and physiology in health, aging, and disease.

Derived from text

Eye (Anatomy); Health; Signs and Symptoms

20050199472 NASA Glenn Research Center, Cleveland, OH, USA

LIFT Tenant Is Off and Running

Steele, Gynelle C.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Lewis Incubator for Technology (LIFT) tenant, Analiza Inc., graduated from the incubator July 2000. Analiza develops technology and products for the early diagnosis of diseases, quality control of bio-pharmaceutical therapeutics, and other applications involving protein analyses. Technology links with NASA from existing and planned work are in areas of microfluidics and laser light scattering. Since their entry in LIFT in May, 1997, Analiza has: Received a \$750,000 grant from the National Institutes of Health. Collaborated with a Nobel Prize winner on drug design. Collaborated with Bristol-Myers Squibb on the characterization of biological therapeutics. Added a Ph.D. senior scientist and several technicians. Received significant interest from major pharmaceutical companies about collaborating and acquiring Analiza technology.

Author

Quality Control; Pharmacology; Health; Diseases; Diagnosis

20050200777 Texas Univ., Austin, TX USA

Synthesis of Acetogenin Analogs as Potential Therapeutics for Treating Prostate Cancer

Pagenkopf, Brian L.; Jul. 2004; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0109

Report No.(s): AD-A435211; No Copyright; Avail: CASI; [A02](#), Hardcopy

New, flexible, economical, and practical syntheses of the natural products swuamotacin and bullatacin have been completed. The compounds have been submitted for biological testing, and preparation of analogs is underway. This work will provide much needed information on the structure activity relationships of this class of annonaceous acetogenins. The Promising and sometimes contradictory reports on the biological activity of the acetogenins will be solidly addressed in this work, and these findings will be essential tools in the exploitation of these compounds for their therapeutic potential in the fight against prostate cancer.

DTIC

Cancer; Prostate Gland

20050200778 Beth Israel Deaconess Medical Center, Boston, MA USA

Lymphatic Regeneration Within Porous VEGF-C Hydrogels for Secondary Lymphedema

Contreras, Mauricio A.; Jul. 2004; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0152

Report No.(s): AD-A435222; No Copyright; Avail: CASI; [A03](#), Hardcopy

Lymphedema is an abnormal swelling, in which lymph production exceeds drainage capabilities. This occurs as a result of lymphatic vessel destruction during the removal of lymph nodes or subsequent radiation therapy in breast cancer treatment. Management of lymphedema remains a clinical problem. In adult lymphangiogenesis, VEGF-C has been shown to be a specific mitogen for lymphatic endothelial cells (LEC) via the VEGF-3 receptor. Ang-2 has recently been shown to be required for proper lymphatic development via the Tie 2 receptor. In our model we incorporated into alginate gels, Ang-2 and VEGF-C to promote lymphoangiogenesis by stimulating LEC proliferation and migration. Sterile alginate gels with Ang-2 (2ug/ml) and VEGF-C (200ng/ml) were tested in vivo for LEC proliferation and migration. Previous in vitro studies demonstrated that by adding Ang-2 to the VEGF-C alginate gels, LEC proliferation and migration increased, when compared to VEGF-C alginate gels alone. Our Preliminary animal (n =6) studies in a tail lymphedema animal model using these alginate gels (Ang-2/VEGF-C) suggests that lymphoangiogenesis does occur. Our preliminary in vivo results demonstrate that alginate gels are an effective delivery system of Ang-2 and VEGF-C, in which new tubular structures are formed resembling lymphatic vessels (Histology). Further animal studies (Lymphocintography) are required to evaluate these new tubular structures and their capability in restoring lymphatic function in vivo.

DTIC

Breast; Cancer; Lymphatic System; Mammary Glands; Porosity

20050200779 Baylor Coll. of Medicine, Houston, TX USA

Research Training Program in Breast Cancer

Medina, Daniel; Jul. 2004; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9073

Report No.(s): AD-A435226; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this research training program is to produce highly qualified scientists for careers as independent investigators in the field of breast cancer. During the last 25 years, there has been a fundamental revolution in the understanding of molecular and cell biological concepts related to cell growth, function and tumorigenesis. To utilize what has been learned and to continue future progress in the area of breast cancer requires the continued availability of well-trained, innovative and committed scientists. This program represents an interdepartmental training program involving 15 investigators from seven departments. Trainees are predoctoral and postdoctoral fellows with backgrounds in bio-chemistry, cell and molecular biology, molecular genetics and molecular virology. The training program provided trainees with additional foundation in carcinogenesis and breast cancer. In addition to the core curriculum taken by the predoctoral fellow in their respective academic departments, program enhancement is provided through trainees' participation in a graduate course on 'Molecular Carcinogenesis' (predoctoral fellows), a Breast Disease Research Seminar (all trainees) and participation at national meetings and local seminars. Predoctoral and postdoctoral trainees are enrolled in the program.

DTIC

Breast; Cancer; Carcinogens; Education; Mammary Glands; Medical Science; Molecular Biology

20050200780 Washington Univ., Seattle, WA USA

Does the Phenotyping of Disseminated Prostate Cancer Cells in Blood and Bone Marrow Prior to Radical Prostatectomy Provide Prognostic Information?

Vessella, Robert L.; Jul. 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0115

Report No.(s): AD-A435227; No Copyright; Avail: CASI; [A03](#), Hardcopy

Nearly 20% of men who undergo a radical prostatectomy later relapse with bone metastases. The cellular events that are predictive of subsequent progressive disease remain unknown. We've focused attention on the detection of disseminated prostate cancer (Cap) cells in the blood and bone marrow. Our hypothesis is that these disseminated cells may provide critical insight regarding biomarkers of use in prognostication. We've developed enrichment and isolation techniques that allow the isolation of individual disseminated CaP cells for study as a pool of cells or single cells. Our proposal is to isolate these cells from 50 patients prior to radical prostatectomy and from 10 patients with advanced disease. The cells will be both phenotypically and molecularly analyzed. To date 96 patients have been accrued and the analyses well underway. For example, we are finding that 57% of patients prior to radical prostatectomy have disseminated CaP cells in their bone marrow. Also,

we show a correlation between patients with cytokeratin positive cells and human epithelial positive cells. In 56% of specimens having disseminated CaP cells we found aberrant features of chromosome 8 by FISH analysis. Micro-array gene expression analysis is planned on single cells from the first 10 patients to recur.

DTIC

Blood; Bone Marrow; Bones; Cancer; Detection; Isolation; Metastasis; Prostate Gland; Radicals

20050200781 Texas Univ., Smithville, TX USA

Studies of Prostate Tumor Development via Cre/LoxP Technology

Conti, Claudio J.; May 2004; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0068

Report No.(s): AD-A435229; No Copyright; Avail: CASI; [A02](#), Hardcopy

The purposes of this research are to investigate cell lineages in the prostate gland of the mouse and to identify the cellular origin of prostate adenocarcinomas. The prostate epithelium contains, among others, luminal and basal cells. It is believed, but not proven, that a subpopulation of the basal cells may be stem cells (1) and that basal cells differentiate into luminal cells (2, 3). On the other hand, prostate cancer cells have characteristics of luminal cells (4). This project aims to use Cre/loxP technology (Sauer, 1998) to develop mice in which different prostate cell subpopulations are permanently labeled. Hereto, mice have been generated that express, constitutively or upon tamoxifen treatment, Cre recombinase under the control of keratin 5 (K5) or K14 promoters (active in basal cells (6)) or the probasin (PB) promoter (active in luminal cells of adult male mice (6)). These mice have been crossed with ROSA26 mice (7), which harbor a universal promoter driving a Beta-galactosidase (13-gal) reporter gene preceded by a floxed stop sequence. In the resulting litter, Cre-mediated recombination is expected to remove the stop sequence and lead to permanent labeling of a cell subpopulation with 13-gal.

DTIC

Cancer; Prostate Gland; Tumors

20050200782 Michigan Univ., Ann Arbor, MI USA

Role of the Human Polyomavirus, BKV, in Prostate Cancer

Imperiale, Michael; Aug. 2004; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0076

Report No.(s): AD-A435230; No Copyright; Avail: CASI; [A03](#), Hardcopy

BKV is a human polyomavirus that establishes a lifelong, persistent infection of the urinary tract. The virus encodes oncoproteins that induce tumors in animal models, and BKV DNA has been detected in human urinary tract tumors, including prostate. Prostate tumors have a relatively low frequency of mutations in the p53 and Rb1 genes, indicating that an agent such as a Virus may be inactivating their functions. The aims of this proposal are to determine if BKV is present in prostate tumors and, if so, whether viral oncogenes are expressed. To accomplish this, normal and tumor tissue from individual patients will be analyzed. PCR, in situ PCR, and in situ hybridization will be performed to determine the presence of viral sequences, and RT-PCR and immunohistochemistry will be used to examine gene expression. Viral sequences from patients will be cloned and their function compared to wild type virus. This past year, we optimized most of these assays and began to analyze samples. We detect the presence and expression of the virus in a subset of normal and cancer cells. At this time, firm conclusions cannot be drawn as more samples need to be analyzed. If BKV is associated with some prostate cancers, our knowledge of the virus will be useful in designing drugs and vaccines for treatment.

DTIC

Cancer; Carcinogens; Detection; Prostate Gland; Tumors; Urology; Viruses

20050200783 Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM USA

DU Fragment Carcinogenicity: Extrapolation of Findings in Rodents to Man

Hahn, Fletcher F.; Mar. 2004; 59 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0788

Report No.(s): AD-A435231; No Copyright; Avail: CASI; [A04](#), Hardcopy

Rats with implants of DU or injections of Thorotrast(Federal Registration) in muscles developed soft tissue sarcomas (STS). Tissue samples from this previously conducted life-span study were used to determine certain molecular changes associated with the STS induction. Significantly increased p53 expression was present in DU- induced STS compared with those induced by Thorotrast(Federal Registration). However, p53 expression was not found in the few microscopic tumors of the capsules around the implants or in benign tumors. Expression of the oncogenes MDM2, c-myc, and p21 was low and not

related to DU or Thorotrast(Federal Registration). The oncogene K-ras was not mutated in any tumors. The pattern of differential gene expression in the DU-induced STS was not similar to the Thorotrast(Federal Registration)-induced STS. Few expressed genes were similar and many were exclusively expressed. These findings suggest that the mechanism of carcinogenesis is not the same for DU and Thorotrast(Federal Registration) induced STS. Histologic study of the embedded DU showed that the DU rapidly corrodes in muscle. In 7 days corrosion, and the acute tissue reaction to it, was visualized in radiographs of the tissues. Corrosion continued causing an enlargement of the embedded DU on radiographs. This information may be useful in interpreting radiographs of DU embedded in humans.

DTIC

Carcinogens; Extrapolation; Fragments; Rodents

20050200784 Maryland Univ., Baltimore, MD USA

Motivators and Barriers to Seeking Prostate Cancer Screening and Treatment of Urban African-American Men

Plowden, Keith O.; Derogatis, Leonard; Sep. 2004; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0073

Report No.(s): AD-A435233; No Copyright; Avail: CASI; [A02](#), Hardcopy

African American men are disproportionately affected by prostate cancer. In order to positively impact this disease, early interventions that encourage early detection and treatment are essential. The overall objective of this study is to explore motivators and barriers to seeking prostate cancer screening and treatment among urban African-American men. The proposed study has 2 phases. During phase 1, ethnographic interviews will be conducted with African- American men and other individuals who have insight into their culture. These other individuals could include health care providers and significant others of African-American men. Twenty-two informants were interviewed. After analysis of the qualitative data, the Plowden/Young Prostate Cancer Belief Instrument was refined. Psychometric properties of the instrument will be established, and data collection will begin. The findings will be utilized to design culturally appropriate intervention that will motivate urban African-American men to seek early prostate cancer screening, participate in clinical trials, and seek effective treatment.

DTIC

Africa; Cancer; Data Acquisition; Detection; Human Beings; Males; Prostate Gland

20050200785 Emory Univ., Atlanta, GA USA

Disruption of Dopaminergic and Cholinergic Function in Military Deployment Implications to Parkinson's Disease

Miller, Gary W.; Nov. 2004; 35 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0793

Report No.(s): AD-A435237; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this project is to evaluate the potential of pesticides and other compounds used by the military for their potential to damage the brain dopamine system and increase the risk for Parkinson's disease. Notable research accomplishments over the past year include the following: Deltamethrin increased the expression of DAT, TH, and VMAT2, locomotor activity in C57BL mice. Deltamethrin did not exacerbate the toxicity to the dopamine neurotoxin MPTP either given before or after MPTP. Chlorpyrifos had no effect on dopamine uptake in neuroblastoma cells and did not exacerbate MPTP toxicity. Pyridostigmine bromide had no effect on dopamine uptake in neuroblastoma cells. JP-8 jet fuel is toxic to neuroblastoma cells only at 1 mM concentrations. No toxicity was seen at concentrations from 100 nM to 500 uM. Thus, with all of the compounds studied we have not observed toxicity consistent with a compound that would be thought to cause overt damage to the dopamine system. However, we have seen alterations of the dopamine system that must be studied further. The completion of this study will reveal the impact of militarily relevant agents on the pathogenesis of Parkinson's disease and hopefully lead to strategies and policies that reduce the incidence of the disease.

DTIC

Brain; Bromides; Cholinergics; Deployment; Diseases; Dopamine; Locomotion; Military Operations; Neurophysiology; Pesticides

20050200786 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Multifactorial Assessment of Depleted Uranium Neurotoxicity

Jortner, Bernard; Oct. 2004; 100 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0775

Report No.(s): AD-A435240; No Copyright; Avail: CASI; [A05](#), Hardcopy

This is a four-year study on the neurotoxic potential of depleted uranium (DU) in laboratory rats. Previous studies with

Gulf War veterans and experimental animals exposed to embedded DU suggest that neurotoxicity may result from DU exposure (McDiarmid et al. 2000; Pellmar et al., 1999). The current investigation is designed to assess the neurotoxic potential of acute and chronic exposure to DU and the contribution of stress to expression of DU neurotoxicity and kinetics. All studies are being performed with adult male Sprague-Dawley rats. As noted in the Table below, the components of this project are as follows: 1- Dose-finding and preliminary toxicokinetic studies of DU. These were conducted in the Year 1 of the project 2- Pilot stress study- To obtain an optimal model of experimental stress for use in the acute and chronic DU exposure studies. This was done in Year 2 and Year 3. 3- Acute neurotoxicity of soluble DU (uranyl acetate)- To determine nervous system kinetics and toxicity of DU. This was a major focus in Year 3. The in-life portion was done, and the neurobehavioral and most of the neurochemical data were obtained and analyzed. Neuropathological studies of the brain were also performed in this year. Tissue uranium assays were done in part. 4- Long-term toxicity study- This will assess chronic exposures from implanted solid DU particles, a model of some Gulf War casualties. This study began in Year 3, and is in progress.

DTIC

Spent Fuels; Uranium

20050200787 Beth Israel Deaconess Medical Center, Boston, MA USA

Mechanism of Cadherin Switching in Breast Carcinoma

Bellovin, David I.; Apr. 2005; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0339

Report No.(s): AD-A435244; No Copyright; Avail: CASI; [A02](#), Hardcopy

During the progression of cancer, cells often undergo an epithelial-mesenchymal transition (EMT). This is associated with trading intercellular adhesion for a motile phenotype, as cells lose E-cadherin and gain the pro-migratory N-cadherin. While this process of cadherin switching has been described previously, the underlying molecular mechanism has yet to be elucidated. Here, we examine the role of p120 catenin (p120ctn) and the Kaiso transcription factor as mediators of cadherin switching in breast cancer. It is proposed that EMT-induced loss of E-cadherin results in the interaction of p120ctn with Kaiso transcription factor to induce expression of N- Cadherin. This is supported by the presence of putative Kaiso binding sites in the N-cadherin promoter. Moreover, p120ctn co-localizes with Kaiso in cells that have lost E-cadherin but not in those that maintain its expression. To confirm this role for p120ctn, co-immunoprecipitation of this protein with Kaiso will be utilized in an EMT model of breast cancer. Further, siRNA will be employed to demonstrate the necessity of these two proteins in EMT-induced cadherin switching. These experiments will describe a reasonable and novel mechanism for cadherin in breast cancer, while lending itself directly to the design of new therapies targeted at inhibiting breast cancer metastasis.

DTIC

Breast; Cancer; Mammary Glands; Metastasis; Switching

20050200788 Johns Hopkins Univ., Baltimore, MD USA

Role of Polyamine Oxidase (PAOH1/SMO) in Human Breast Cancer

Pledge, Allison M.; Apr. 2005; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0457; DAMD17-03-1-0167

Report No.(s): AD-A435245; No Copyright; Avail: CASI; [A02](#), Hardcopy

Bis(ethyl)nor-spermine (BENSpm) is a spermine analogue that has shown antitumor activity in multiple human tumor models. This project evaluates the ability of BENSpm to induce the polyamine catabolic enzyme spermine oxidase, SMO(PAOH1), in human breast cancer cell lines and examined the role of its induction in the overall response of breast cancer cell lines to BENSpm treatment. BENSpm differentially induced SMO(PAOH1) mRNA and activity in several breast cancer cell lines. The greatest induction was seen in MDA-MB-231 cells, which exhibited a time- and dose- dependent induction of SMO(PAOH1) mRNA and activity with BENSpm treatment. Although SMO(PAOH1) was not induced in MCF-7 and T47D cells, BENSpm exposure inhibited cell growth, decreased intracellular polyamine levels, decreased ODC activity, and induced SSAT activity in all of the cell lines examined. Inhibition of SMO(PAOH1) activity with the polyamine oxidase inhibitor MDL 72,527 reduced the sensitivity of MDA-MB-231 and Hs578t cells to BENSpm but had no effect on the response of MCF-7 and T47D cells to exposure to BENSpm. These results indicate that the induction of SMO(PAOH1) may play a role in the response of specific breast cancer cell lines to BENSpm treatment.

DTIC

Breast; Cancer; Mammary Glands; Oxidase

20050200790 Creighton Univ., Omaha, NE USA

Ethnic and Environmental Influence on Vitamin D Requirement in Military Personnel

Heaney, Robert P.; Oct. 2004; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0818

Report No.(s): AD-A435260; No Copyright; Avail: CASI; [A02](#), Hardcopy

The purposes of this study are to provide quantitative estimates of 1) the effective amount of vitamin D produced in the skin as a function of skin pigmentation; and 2) the rate of utilization of vitamin D as a function of ethnicity. The outcome will be estimates of the amount of vitamin D that must be given orally to military personnel of different races and in different assigned locations so as to ensure and maintain normal vitamin D status. In the first 27 months' work (the period covered by this report), we have accumulated about 80% of the targeted specimens - for both objectives, in a racially diverse sample. Analyses are continuing and will be completed within the coming months. No final quantitative results will be available until all the measurements have been, made and analyzed as a unit.

DTIC

Calciferol; Ethnic Factors; Military Personnel

20050200791 Pennsylvania Univ., Philadelphia, PA USA

Mechanism of erbB1 and erbB2 Hetero-Oligomerization

Yu, Jong W.; Lemmon, Mark A.; Jul. 2004; 24 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0370

Report No.(s): AD-A435261; No Copyright; Avail: CASI; [A03](#), Hardcopy

We are developing an in vivo system using erbB/IL2 receptor chimerae in a B-cell line to investigate, the interactions and mechanism of oligomerization between the epidermal growth factor (EGF) receptor family members erbB1 and ERBB2. Since erbB2 overexpression has been strongly associated with breast cancer and has been shown to be a valuable target for breast cancer therapies, we are interested in dissecting its mechanism of activation. Heteromeric interaction between the intracellular domains of the IL2 receptor beta and gamma chain will serve as a reporter for direct interaction between the extracellular domains of erbB1 and erbB2 by mediating T or B-cell proliferation in the absence of IL2. Previously, we have demonstrated erbB1 homo-oligomerization and hetero-oligomerization with erbB2 in an EGF dependent manner. Due to problems in generating required cell lines expressing multiple chimeric receptors, we have not been able to address the remaining aims and have recently focused considerable effort to this end with little success. With further work, we hope to fully develop this assay to understand how erbB1 and erbB2 interact and to provide insight into the mechanism by which erbB2 mediates transformation and tumorigenicity in cells.

DTIC

Breast; Cancer; Mammary Glands

20050200792 Louisiana State Univ., Baton Rouge, LA USA

Investigating the Mechanisms of Action and the Identification of Breast Carcinogens by Computational Analysis of Female Rodent Carcinogens

Cunningham, Albert R.; Aug. 2004; 57 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0376

Report No.(s): AD-A435262; No Copyright; Avail: CASI; [A04](#), Hardcopy

This project is investigating the potential that environmental estrogens may be involved in the etiology of breast cancer. We hypothesize that specific features of chemicals can be identified that are significantly associated with female and breast carcinogens and that these features are related to mechanisms of chemical carcinogenesis. Our overall scientific objective is to investigate the hypothesized relationship between environmental chemicals, xenoestrogens, and the development of breast cancer. With the success of the rat and mouse mammary carcinogen models we are preparing two manuscripts for publication. We are also pursuing work on a general chemical carcinogen manuscript and a one describing female-specific carcinogens. Also of importance, we are working on several xenoestrogen models that, although not detailed in the project proposal, will be of great importance for understanding the endocrine disruptor link to breast cancer. We have also developed a new structure-activity relationship program called cat-SAR that is producing predictive and mechanistically insightful models of mammary carcinogens. Looking forward I see no obstacles to the successful completion of this project in a timely manner.

DTIC

Analysis (Mathematics); Breast; Carcinogens; Etiology; Females; Mammary Glands; Rodents

20050200793 Texas Univ., Galveston, TX USA

Novel Drug Delivery Technique for Breast Cancer Therapy

Esenaliev, Rinat O.; Jul. 2004; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0416

Report No.(s): AD-A435264; No Copyright; Avail: CASI; [A02](#), Hardcopy

This report describes the progress achieved during the third year of the project. We proposed to complete Task 3 and to implement Task 4 in the third year of the project. Task 3 focuses on in vivo studies of efficacy of cancer therapy with the use of ultrasound-enhanced delivery of anti-cancer drug 5-FU (low-molecular weight drug) in human MCF-7 breast tumors of nude mice. We started to implement Task 4 which is devoted to in vivo studies of efficacy of cancer therapy with ultrasound-enhanced delivery of macromolecular anti-cancer drug Interleukin-2 (anti-cancer drug with high molecular weight). We partially conducted these studies to implement the proposed tasks. Our data obtained during these chronic experiments indicate that this technique may significantly improve breast cancer therapy. We have found that volume of ultrasound-irradiated tumors decreases when mice are injected with anti-cancer drug in combination with cavitation-mediating agent, while non-irradiated tumors of same mice grow. No improvement in cancer therapy was obtained when no cavitation-mediating agent was used. These results are very encouraging. To complete these studies, we requested a no-cost extension which was granted. The proposed studies will be implemented by the end of the project.

DTIC

Breast; Cancer; Drugs; Irradiation; Mammary Glands; Therapy; Ultrasonics

20050200794 Pennsylvania Univ., Philadelphia, PA USA

Adhesion-Linked Protein Tyrosine Phosphatases, Morphogenesis and Breast Cancer Progression

Weaver, Valerie M.; Jul. 2004; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0496

Report No.(s): AD-A435265; No Copyright; Avail: CASI; [A03](#), Hardcopy

Stromal-epithelial interactions regulate mammary epithelial cell (MEC) fate via integrin-growth factor receptor (GFR) interactions. Integrin-GFR crosstalk influences MEC behavior through activation of tyrosine kinase signaling that is tempered by protein tyrosine phosphatase (PTP) activity of which we know little about. Using a degenerate RT-PCR to amplify PTPs expressed in differentiated versus non-differentiated MECs, we identified the Band 4.1 PTPs MEG1 and DI as two candidate PTP metastasis suppressors. Our studies show that during MEC differentiation PTP MEG1 and DI expression rise dramatically, coincident with assembly of E-cadherin/Beta-catenin adherens junction formation. However, both mRNA and protein expression of MEG1 and DI become repressed following MEC tissue differentiation. Because we could not establish any correlation between MEC growth, or tissue polarization, this suggests that MEG1 and DI expression may be functionally linked to adherens junction assembly. Consistently, malignant MECs that fail to assemble adherens junctions do not modulate MEG1 or DI expression. Moreover, MEG1 expression is not induced in phenotypically reverting tumors, or down regulated in dormant structures. This suggests that these Band 4.1 PTPs may be functionally-linked to molecules mediating adherens junction formation.

DTIC

Adhesion; Breast; Cancer; Mammary Glands; Proteins; Tyrosine

20050200795 Georgetown Univ., Washington, DC USA

An Epithelial-Derived, Integral Membrane, Kunitz-Type serine Protease Inhibitor in Breast Cancer

Lin, Chen-Yong; Aug. 2004; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0252

Report No.(s): AD-A435266; No Copyright; Avail: CASI; [A02](#), Hardcopy

In the current research plan, we proposed to study the anti-tumor and anti-protease activity of a membrane-bound Kunitz-type serine protease inhibitor (KSPI; also known as HAI-1). In order to investigate how HAI-1 regulates matriptase function, we investigated the cellular events associated with matriptase activation. During matriptase activation induced either by S1P or suramin, HAI-1 along with matriptase is translocated and accumulated at cell-cell junctions or in vesicle-like structures, which were named as matriptase activation foci. In activation foci, HAI-1 binds active matriptase to form a 120-kDa complex immediately following the activation of matriptase. The close temporal and spatial coupling of matriptase activation with its inhibition suggests that the proteolytic activity of this enzyme must be well controlled, and that the activation of matriptase substrates may be tightly regulated by this mechanism.

DTIC

Activation; Breast; Cancer; Enzymes; Inhibitors; Mammary Glands; Membranes; Metastasis; Protease

20050200796 Duke Univ., Durham, NC USA

Regulation of EGF Receptor Signaling by Histone Deacetylase 6 (HDAC6)-Mediated Reversible Acetylation

Kovacs, Jeffrey J.; Apr. 2005; 39 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0167

Report No.(s): AD-A435267; No Copyright; Avail: CASI; [A03](#), Hardcopy

One of the hallmarks of cancer is uncontrolled cell growth and proliferation. In cells, a group of proteins called growth factor receptors are responsible for responding to the signals that trigger proliferation. When these receptors function abnormally due to genetic mutation, these can undergo uncontrolled proliferation and become cancerous. In the case of breast cancer, a specific group of growth factor receptors, the ErbB family, have been implicated in the formation of tumors. In order to prevent uncontrolled growth, normal cells tightly regulate the activity of the EGF receptors. Upon their activation, which initiates the signaling that triggers cell proliferation, the receptor is also programmed to be destroyed in order to stop growth factor-induced signaling. A defect in this destructive mechanism can result in abnormally active EGFR, which can lead to uncontrolled signaling, and thus tumor formation. Recently, it has been shown that Hsp90 (heat shock protein 90) is able to bind EGFR, and prevent its destruction. The ability of Hsp90 to bind substrate proteins appears to be regulated by a small chemical modification termed reversible acetylation. Hsp90 appears to require deacetylation in order to properly interact with its substrates. This would suggest that the modulation of Hsp90 acetylation status will be important for EGFR-mediated cell proliferation. Our lab has found that Hsp90 interacts with HDAC6 (histone deacetylase 6), which is a protein that acts to remove acetyl groups from proteins (deacetylation), and we hypothesize that this interaction plays a regulatory role in EGFR functioning. We aim to characterize the interaction between these proteins, and determine how this interaction effects EGFR signaling. In addition, we will examine the role of HDAC6 in EGFR-mediated breast cancer formation in a tissue culture model.

DTIC

Acetylation; Breast; Cancer; Mammary Glands; Proteins

20050200797 Georgetown Univ. Hospital, Washington, DC USA

Polyphosphate Affects on Breast Cancer Cell Survival

Haakenson, Christine L.; Apr. 2005; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0379

Report No.(s): AD-A435268; No Copyright; Avail: CASI; [A02](#), Hardcopy

Goals met during the first funding period of this grant include developing methodologies to measure cellular polyphosphosphate concentrations in breast cancer cells and the preparation of breast cancer cell lines with altered levels of polyphosphate. Specifically, a reproducible and quantitative procedure to extract and enzymatically measure polyphosphate concentrations in breast cancer cells is now in hand. Additionally, a plasmid containing a copy of the *S. cerevisiae* exopolyphosphatase (scPPX) gene behind a constitutively active CMV promoter was constructed and successfully stably transfected into breast cancer cell lines. scPPX degrades polyphosphate by processively removing the terminal phosphate moiety from the polyphosphate polymer. Thus, the presence of extra copies of scPPX results in depleted levels of cellular polyphosphate. These accomplishments of the first funding period provide the necessary tools to investigate the link between cellular polyphosphates and breast cancer, as outlined in the proposal.

DTIC

Breast; Cancer; Mammary Glands; Survival

20050200798 Baylor Coll. of Medicine, Houston, TX USA

Role of Reactive Stroma in Prostate Cancer Progression

Rowley, David R.; Feb. 2005; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0189

Report No.(s): AD-A435269; No Copyright; Avail: CASI; [A02](#), Hardcopy

The purpose of this project is to determine the role of FGF receptor 1 in reactive stroma during prostate tumorigenesis. We are using a novel approach to target transgene expression specifically to the reactive stroma of experimental prostate cancer. We are placing an inducible Cre recombinase into the FGF gene locus to target expression to reactive stroma. We will cross this mouse with Fgfr1^{fl} mice (LoxP sites flanking FGF receptor 1 alleles). These mice will be crossed with TRAMP mice (prostate cancer model). Induced expression of Cre at sites of reactive stroma generated in the cancer foci will function to excise the FGF receptor 1 alleles and create a conditional knockout mouse. Progression of tumorigenesis in this line of knockout mice will be compared to heterozygous and wild type controls. We have acquired all clones and reagents and have completed rederiving the Fgfr1^{fl} by embryo transfer. We have nearly completed generating and verifying the constructs

necessary to target Ore and the five generations of breeding necessary to obtain the desired genetic background of mice. This study will pinpoint the role of FGF receptor in prostate cancer progression and will help in designing a targeted therapeutic to cancer reactive stroma.

DTIC

Cancer; Prostate Gland; Reactivity

20050200799 University Health Network, Toronto, Ontario Canada

Molecular Determinants of Radio Resistance in Prostate Cancer

Bristow, Robert G.; Molosevic, Michael; Warde, Pdraig; Lilge, Lothar; Squire, Jeremy; van Weerden, Wystke; Aug. 2004; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0110

Report No.(s): AD-A435270; No Copyright; Avail: CASI; [A03](#), Hardcopy

We are studying the radiation response of prostate tissues in relation to the sensing and repair of DNA breaks. Specific aims relate to determining the interaction of DNA repair proteins in vitro using immunofluorescent confocal microscopy and biochemical DNA rejoining assays under both hypoxic and oxic conditions (given in vivo tumour cell populations). An in vivo program of prostate xenograft radioresponse and patient biopsy studies will determine the level of DNA repair in situ using immunohistochemistry and immunofluorescent markers. Our studies show that DNA repair protein expression is abnormal in malignant versus normal prostate epithelial cultures, and that particularly the Rad51 protein is defective in localizing to the nucleus following DNA damage. We have accrued 13 patients onto a pre-operative radiotherapy trial and post-irradiation immunohistochemistry supports an induction of p53-pathway signaling following 25Gy in 5 fractions. Current experiments are designed to determine whether DNA protein focal interactions using 2-photon microscopy can predict the radioresponse of prostate xenografts and human tumors, in vivo. Our studies support the use of novel molecular based therapies that target DNA repair for prostate cancer therapy.

DTIC

Cancer; Prostate Gland

20050200801 Health Research, Inc., Buffalo, NY USA

Identification of Prostate Cancer-Related Genes Using Inhibition of NMD in Prostate Cancer Cell Lines

Ionov, Yuri; Jan. 2005; 30 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0045

Report No.(s): AD-A435274; No Copyright; Avail: CASI; [A03](#), Hardcopy

A strategy to identify mutant genes using inhibition of nonsense mediated decay (NMD) in cell lines has been proposed by others. Blocking translation with antibiotic emetine has been shown to inhibit the NMD. Stabilization of mutant mRNA following the inhibition of NMD with emetine can be detected using microarray technology, such as Affymetrix genechips, for example. Unfortunately, too many genes that do not contain any mutations show mRNA increase following emetine treatment due to stress response to the inhibition of translation or due to being a natural substrate for NMD, thus complicating the identification of mutant genes. We have developed a simple analytical method that increases the efficiency of identifying mutant genes in cell lines following inhibition of nonsense mediated decay (NMD). The approach assumes that the spectra of mutant genes differ between cell lines of the same tumor origin. Using this analytical filter we have identified previously unknown inactivating mutations in the Jak1, Synaptojanin2 (SYNJ2) and Cleft Lip and Palate Transmembrane Protein 1 (CLPTM1) genes in the prostate cancer cell line LNCaP. A list of candidate genes for sequencing analysis has been generated for the other prostate cancer cell lines.

DTIC

Cancer; Genes; Oncogenes; Prostate Gland; Suppressors

20050200802 Baylor Coll. of Medicine, Houston, TX USA

Hormonal Regulation of Mammary Gland Development and Breast Cancer

Xian, Wa; Rosen, Jeffrey M.; Dec. 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0285

Report No.(s): AD-A435276; No Copyright; Avail: CASI; [A03](#), Hardcopy

Our laboratory is interested in studying the mechanisms by which lactogenic hormones regulate Beta-casein gene expression and how alterations in the levels of these hormones may function in the growth promotion of breast tumors. To understand the role of C/EBPBeta, STAT5, GR and comodulatory factors in hormonally-regulated chromatin remodeling at

the Beta-casein promoter and enhancer, we have performed RNA analysis and chromatin immunoprecipitation assays in HC11 mammary epithelial cells and the mouse mammary gland. At present, we have developed the ChIP assay and optimized it for use in HC11 cells and successfully extended these studies to lactating mammary gland tissue and liver. We have been able to demonstrate rapid acetylation at both the promoter and the enhancer regions after stimulation of cells with prolactin and hydrocortisone. We used antibodies to different transcription factors in modified ChIP assays and employed real time PCR for quantitative analysis following treatment with prolactin alone, hydrocortisone alone, or both hormones in HC11 cells. More recently, we have been able to demonstrate the chromatin association of GR with C/EBPBeta and recruitment of C/EBPBeta in chromatin remodeling of HC11 cells treated with both prolactin and hydrocortisone. We are currently investigating the kinetics of C/EBPBeta binding at the Beta-casein gene promoter and enhancer. These studies should help elucidate the mechanisms by which hormonal regulated signal transduction pathways regulate mammary-specific gene expression.

DTIC

Breast; Cancer; Hormones; Mammary Glands; Pituitary Hormones; Proteins

20050200803 Dana Farber Cancer Inst., Boston, MA USA

The Development of Novel Small Molecule Inhibitors of the Phosphoinositide-3-Kinase Pathway Through High-Throughput Cell-Based Screens

Sellers, William R.; Feb. 2005; 33 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0169

Report No.(s): AD-A435277; No Copyright; Avail: CASI; [A03](#), Hardcopy

Our group previously showed that FOXO proteins are aberrantly localized to the cytoplasm in cells that have sustained loss of functional PTEN. Moreover, reconstitution of PTEN function to such cells leads to restoration of FOXO to the nucleus. To a first approximation, small molecules that recapitulate this activity of PTEN, i.e. lead to re-distribution of FKHR from the cytoplasm to the nucleus, should lead to inhibition of cell-cycle progression and suppression of tumorigenicity of PTEN null cells. These data led us to ask whether a novel cell-based small-molecule screen could be developed using FKHR localization as an end-point. preliminary data showed that this was feasible and led to the discovery of novel small molecule inhibitors of the PI3K pathway. Based on these results we proposed 3 specific aims: 1) To determine the mechanism of action of inhibitors that specifically re-localize FKHR to the nucleus 2) To determine the in vitro biological activity of small molecule inhibitors discovered in the FKHR screen. 3) To determine the in vivo anti-tumor efficacy of lead compounds in animal models.

DTIC

Enzyme Activity; Neoplasms

20050200804 Mayo Clinic, Scottsdale, AZ USA

Immunotherapeutic Strategies in Breast Cancer: Preclinical and Clinical Trials

Gendler, Sandra J.; Sep. 2004; 159 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0318

Report No.(s): AD-A435278; No Copyright; Avail: CASI; [A08](#), Hardcopy

This project is focused on novel tumor vaccines directed at MUC1 and other tumor antigens. The authors' specific aims are as follows: (1) to assess the effectiveness of vaccines against MUC1 and other tumor antigens in the prevention and treatment of spontaneous breast carcinomas in mice, and (2) to translate an effective vaccine strategy into a phase I clinical trial in patients with undetectable disease following standard therapy. The model of spontaneous mammary cancer is the MUC1-expressing polyoma middle T antigen mice (MMT). The authors have tested five vaccines in the preclinical mouse model: (1) liposomal MUC1 tandem repeat peptide, (2) dendritic cells (DCs) pulsed with tumor lysate, (3) DCs fused to MMT tumor cells, (4) adoptive transfer of MUC1-specific cytotoxic T lymphocytes (CTLs) with CD137 co-stimulation, and (5) MUC1 peptides with CpG ODN and GM-CSF as adjuvants. Results show that all the vaccines elicited a strong immunological response. Adoptive transfer of MUC1-specific CTLs with co-stimulation (CD137 mAb) significantly reduced tumor burden and tolerance in MMT mice. The peptide vaccine prevented MUC1-expressing tumor growth. The clinical trial is in the final stages of review. It is a phase I trial testing MUC1 and HER-2/neu class I and class II peptides with CpG ODN and GM-CSF adjuvants in breast cancer patients free of disease.

DTIC

Antigens; Breast; Cancer; Mammary Glands; Vaccines

20050200805 Baylor Coll. of Medicine, Houston, TX USA

The Scaffold Attachment Factor SAFB1P: A New Player in G2/M Checkpoint Control

Oesterreich, Steffi; Apr. 2005; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0423

Report No.(s): AD-A435280; No Copyright; Avail: CASI; [A02](#), Hardcopy

Loss of G2/M checkpoint plays an important role in tumorigenesis, however, few genes involved in this checkpoint control have been shown to be deregulated in human breast tumors. SAFB1 is a multifunctional protein which maps to a locus of high LOH, and mutations have been identified from both breast cancer -cell lines and tumors. Our preliminary data show that inactivation of SAFB1 in MEFs result in loss of G2/M checkpoint control, and that loss of SAFB1 expression is associated with Taxotere resistance in human breast tumors. We therefore hypothesize that SAFB1 is critical for G2/M checkpoint control, and that its inactivation results in resistance to breast cancer therapies that utilize a block in G2/M and subsequent apoptosis. We will identify the mechanism by which SAFB1 controls the G2/M checkpoint, and will subsequently analyze whether Taxotere-resistant tumors show altered expression of genes involved in these pathway(s).

DTIC

Breast; Cancer; Mammary Glands; Neoplasms

20050200806 Northwestern Univ., Evanston, IL USA

Constitutive Activation of NF-kappaB in Prostate Carcinoma Cells Through a Positive Feedback Loop: Implication of Inducible IKK-Related Kinase (IKKi)

Budunova, Irina V.; Aug. 2004; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0522

Report No.(s): AD-A435282; No Copyright; Avail: CASI; [A03](#), Hardcopy

The overall goal of this project is to understand the role of inducible IKK-related kinase IKKi in constitutive activation of anti-apoptotic transcription factor NF-kB prostate carcinoma (PC) cells. We found that IKKi is highly expressed in PC cell lines with constitutively activated NF-kB. We also performed immunostaining of more than 60 PC and BPH samples using four different antibodies against IKKi. Immunostaining revealed that IKKi was highly expressed in prostate glands, but not in prostate stroma. IKKi signal had both cytoplasm and nuclear localization. Overall intensity of IKKi staining was similar in BPH and in PCs, however, the nuclear expression was higher in PCs. Treatment of PC cells with different NF-kB inducers such as IL-1 alpha, TNF-alpha, and TPA resulted in a rapid induction of IKKi. Consistent with this, down-regulation of NF-kB activity by proteasome inhibitor MG 132 and IKK inhibitor PS1145 attenuated induction of IKKi expression by NF-kB inducers. Transient transfection of different PC cell lines with IKKi w.t. resulted in activation of kB.Luciferase reporter, whereas IKKi dominant negative mutant suppressed basal NF-kB activity in PC cells. These data provide experimental evidence that IKKi could be involved in the regulation of NF-kB activity in PC cells through a positive feedback loop.

DTIC

Cancer; Positive Feedback; Prostate Gland

20050200807 Dartmouth Coll., Hanover, NH USA

Improving Symptom Control, QOL, and Quality of Care for Women with Breast Cancer: Developing a Research Program on Neurological Effects via Doctoral Education

Bakitas, Marie; Ahles, Tim A.; May 2005; 37 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0298

Report No.(s): AD-A435284; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose of this traineeship is to develop the academic and research skills of an expert advanced practice nurse towards achieving the career goal of becoming a Clinical Breast Cancer Research Scientist. In conjunction with the doctoral program, through a mentored research experience, Ms. Bakitas is expanding an established research program on the central nervous system (CNS) effects of breast cancer treatment by developing a parallel focus on the peripheral nervous system effects of chemotherapy, (Chemotherapy-Induced Peripheral Neuropathy CIPN), on quality of life. The major achievements of the trainee that are described in this annual report are successful accomplishment of the planned training activities/tasks originally outlined for the second year, with an additional achievement of ongoing participation as a consultant in a funded neuropathic pain grant, abstract presentations, acceptance of a doctoral proposal, and acquiring an ACS doctoral scholarship. The significance of these achievements is that the training has provided for the ongoing development of a clinical nurse expert in breast cancer research.

DTIC

Breast; Cancer; Chemotherapy; Education; Females; Mammary Glands; Neurology; Physiological Effects; Signs and Symptoms

20050200808 Chicago Univ., Chicago, IL USA

The Role of Capase-8 in Breast Carcinoma Cells

Schickel, Robert; Peter, Marcus; Apr. 2005; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0200

Report No.(s): AD-A435285; No Copyright; Avail: CASI; [A03](#), Hardcopy

Breast cancer is the second leading cause of cancer related death for women in the USA. Interestingly, breast cancer cells often highly express the Fas (CD95/APO-1) receptor, which is well established as an activator of apoptosis (programmed cell death) upon ligand binding. Fas induces apoptosis by recruiting proteins that form the death inducing signaling complex (DISC). Type I cells form large amounts of the DISC and internalize Fas, whereas in Type II cells Fas does not internalize and the DISC is almost undetectable. Additionally the Fas receptor has recently been shown to activate the nonapoptotic NF-KB and MAP kinase pathways upon receptor stimulation in either Type I or Type II cells. We can now demonstrate that in Type I cells the recruitment of DISC largely occurs after the receptor has moved into an endosomal compartment and blocking internalization prevents formation of the DISC. Receptor internalization is not required for NF- κ B and Erkl/2 activation. Consequently dimerization of Fas complexes does not induce internalization of Fas nor apoptosis but is sufficient to induce nonapoptotic-signaling pathways and increases motility and invasiveness of tumor cells. Furthermore, we can demonstrate SNARK's role as a nonapoptotic kinase and promoter of motility and invasion.

DTIC

Apoptosis; Breast; Cancer; Mammary Glands

20050200809 State Univ. of New York, Albany, NY USA

Structure Optimization of 21, 23-Core-Modified Porphyrins Absorbing Long-Wavelength Light as Potential Photosensitizers Against Breast Cancer Cells

You, Youngjae; Apr. 2005; 23 pp.; In English

Report No.(s): AD-A435286; No Copyright; Avail: CASI; [A03](#), Hardcopy

The main subjects of year one were to prepare the diverse structures of core-modified porphyrins, and to examine their physical properties and in vitro biological activities. Twenty five dithiaporphyrin compounds were synthesized with different features in size, symmetry, and electronic property at meso-aromatic groups of the porphyrins. These structural analogues had similar absorption maxima (~700 nm) and quantum yields of singlet oxygen generation (~ 0.8). However, these structural changes showed striking difference in biological activities. Thirteen compounds expressed ~50 % cell kill at 0.5 micrometers and 5-phenyl- 20- (2-thienyl) -10, 15-bis (4-carboxylatomethoxyphenyl) -21,23-dithiaporphyrin was most potent displaying 68% cell kill at 0.1 micrometers with 5 microjoules/squared of light. In a mechanistic study, the porphyrin inhibited cytochrome c oxidase although it did not initially localize in the mitochondria. This enzyme damage can be explained by re-localization of porphyrin during irradiation. Interestingly, the induction of apoptotic cell death with the porphyrin depended on the incubation time with the photosensitizer and its concentration. Longer incubation time with the sensitizer (24 hr) at an appropriate concentration (0.2 micrometers) gave the most apoptosis. Based on the localization pattern with 24 hr incubation and consequent apoptotic process by PDT, there might be a target site inside the cell to trigger.

DTIC

Breast; Cancer; Mammary Glands; Porphyrins

20050200810 Georgetown Univ. Hospital, Washington, DC USA

Strategies of Discovering Small Molecule Drugs Targeting Growth Factor Heregulin

Yang, Dajun; Sep. 2002; 19 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9208

Report No.(s): AD-A435287; No Copyright; Avail: CASI; [A03](#), Hardcopy

Heregulin (HRG) constitutes the HRG subfamily of EGF-related peptides that were isolated from breast cancer cell line MDA-MB-231, and ras-transformed Rat-1 fibroblasts. HRG can stimulate proliferation and may function as an autocrine growth factor in transformed mammary epithelial cells. Stable expression of HRG via transfection leads tumor formation in nude mice and might perform a role in progression to estrogen-independent tumor growth. Furthermore, HRG induces in vivo lobuloalveolar development of mammary gland, and in MMTV-HRG transgenic mice, HRG induces mammary adenocarcinoma, and hyperplasia. Clinically, elevated expression of HRG play a role in breast cancer growth and progression and is associated with less favorable disease outcome. We have used a structure-based strategy towards the discovery of small molecules as potential HRG antagonists. Small, non-peptidal molecules which mimics the 3D structure of HRG binding domain could specifically block ligand receptor-binding. Lead compound SMAI demonstrated activity as specific antagonists of HRG in receptor binding competition, HRG-induced phosphorylation assays and HRG-dependent cell proliferation assays.

Inhibition of HRG-induced phosphorylation or cell growth can be reversed by addition of extra amount of HRG, suggesting the compound SMAI may function as HRG antagonist. The discovery of compounds represents an important step in the development of the small molecule, HRG antagonists as potential clinical candidates in the prevention and treatment of breast cancer.

DTIC

Drugs; Exploration; Tumors

20050200811 Georgetown Univ. Hospital, Washington, DC USA

Mutagen Sensitivity and DNA Repair Gene Polymorphisms in Hereditary and Sporadic Breast Cancer

Santi-Ruiz, Luisel J.; Mar. 2005; 25 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0343

Report No.(s): AD-A435288; No Copyright; Avail: CASI; [A03](#), Hardcopy

Breast cancer risk for both sporadic and familial breast cancer can better be elucidated in studies in women with BRCA1 mutations. Since the BRCA1 protein is involved in DNA repair, genotype-phenotype relationships can be established by the assessment of DNA repair efficiency and the identification of genetic polymorphisms in the BRCA1 DNA repair pathway. To study risks associated with certain polymorphisms in DNA repair genes, EBV-immortalized cells from women in the LCC Registry were used in both a phenotypic assay that measures DNA repair capacity and genotypic assays that determined genotypes that increased susceptibility to breast cancer. Ninety-five affected and 65 healthy BRCA1 mutation carriers are being analyzed in this study. Gamma radiation was used to induce chromosomal breaks and those chromosomal breaks were scored, counted and compared within each patient and between patients. Also, the BRCA1, BRCA2, and Rad51 genes are being sequenced and the genotypes whose polymorphisms code for amino acid changes in conserved and functional areas are being analyzed. We predict that polymorphisms in these genes will be highly correlated with deficient DNA repair in high risk breast cancer families. Several BRCA1 and BRCA2 polymorphisms appear to be associated with decreased DNA repair efficiency. Specifically, the N372H (OR: 7.0 CI: 0.3-140.0) polymorphism in BRCA2, the K1183R (OR: 1.8 CI: 0.1-17.7) polymorphism in BRCA1, and the 5382insC mutation (OR: 3.0 CI: 0.3-29.8), appear to be correlated with mutagen sensitivity, but a larger sample size is needed for odds ratios to be significant. In addition, we have a large population of 187delAG (n=54) and 5382insC (n=21) mutation carriers, so we can begin to look at what polymorphisms will affect risk within those mutation carriers. Ultimately, the study of the high risk families can inform, and set priorities for the study of genetic polymorphisms in sporadic breast cancer studies.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Genetics; Mammary Glands; Mutagens; Mutations; Polymorphism; Sensitivity

20050200812 Hadassah Medical Organization, Jerusalem, Israel

Involvement and Regulation of Heparanase in Prostate Cancer Progression

Elkin, Michael; Feb. 2005; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0235

Report No.(s): AD-A435289; No Copyright; Avail: CASI; [A03](#), Hardcopy

Enhanced heparanase expression correlates with metastatic potential, tumor vascularity and reduced postoperative survival of cancer patients. These observations, the anti-cancerous effect of heparanase gene silencing (ribozyme, siRNA) and of heparanase-inhibiting oligosaccharides, peptides and antibodies, as well as the unexpected identification of a single functional heparanase, suggest that the enzyme is a promising target for anti-cancer drug development. Our studies focused on the regulation of heparanase gene expression (i.e., promoter methylation, action of sex steroids, p53) and effect of augmented levels of the enzyme on malignant behavior of prostate cancer cells. We designed effective inhibitory strategies, based on recently created chemical and molecular tools (chemically modified heparin species, siRNA-expressing vector), as well as on better understanding of biochemical aspects of heparanase proenzyme activations (inhibitory peptide approach), toward future development of effective anti-cancer therapeutic modalities.

DTIC

Cancer; Heparins; Metastasis; Prostate Gland

20050200813 Maryland Univ., Baltimore, MD USA

Baltimore City Faith-Based Prostate Cancer Prevention and Control Coalition

Plowden, Keith O.; Feb. 2005; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0297

Report No.(s): AD-A435290; No Copyright; Avail: CASI; [A02](#), Hardcopy

African American men are disproportionately affected by prostate cancer. In order to positively impact this disease, early interventions that encourage early detection and treatment are essential. The primary purpose of this study is to test an investigator developed community-based intervention that explores the impact of peer-outreach workers on prostate cancer knowledge, perceived benefit and barriers, and overall screening behavior. The target sample for this study will be Black men over age 40 who have never participated in prostate cancer screening. Achievement of this objective will result in an increase in prostate cancer knowledge, an increase in perceived benefit prostate cancer screening and treatment; a decrease in perceived barrier to screening, and an increase in screening among men in the intervention group.

DTIC

Africa; Cancer; Detection; Prevention; Prostate Gland

20050200815 Stanford Univ., Stanford, CA USA

A Novel Yeast Genomics Method for Identifying New Breast Cancer Susceptibility

Brown, Martin; Brown, James A.; May 2005; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0451

Report No.(s): AD-A435292; No Copyright; Avail: CASI; [A03](#), Hardcopy

We are attempting to identify novel genes in the yeast & cerevisiae that confer gross chromosomal instability (GCI) a hallmark of most breast cancers when deleted. Using a yeast strains carrying the deletion of a unique open reading frame, we will transfect a yeast artificial chromosome (YAC) as a reporter for GCI frequency and determine the quantitative impact of the loss of each gene function. We have constructed the reporter with all of the components for selection and maintenance. The URA3 reporter functioned correctly during pool growth but the HSV-TK reporter did not. The human BAX genes has been shown to properly function causing cell death in individual and pooled deletion strains. We are modifying the original YAC to incorporate the BAX construct which is superior to the original design. We will use the new YAC on the pool of yeast strains to identify genes affecting (GCI and determine the mammalian orthologs of these genes as well as those of interacting partners using in silico methods. There is a crucial need to find new candidate genes for breast cancer susceptibility in women and identifying these genes can further improve monitoring and treatment guidelines for women with these mutations. We are attempting to identify novel genes in the yeast & cerevisiae that confer gross chromosomal instability (GCI) a hallmark of most breast cancers when deleted. Using a yeast strains carrying the deletion of a unique open reading frame, we will transfect a yeast artificial chromosome (YAC) as a reporter for GCI frequency and determine the quantitative impact of the loss of each gene function. We have constructed the reporter with all of the components for selection and maintenance. The URA3 reporter functioned correctly during pool growth but the HSV-TK reporter did not. The human BAX genes has been shown to properly function causing cell death in individual and pooled deletion strains.

DTIC

Breast; Cancer; Identifying; Mammary Glands; Yeast

20050200816 Wistar Inst. of Anatomy and Biology, Philadelphia, PA USA

Cytolytic T Lymphocytes in Organotypic Breast Carcinoma Culture

Herlyn, Dorothee; Oct. 2004; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0502

Report No.(s): AD-A435293; No Copyright; Avail: CASI; [A02](#), Hardcopy

In the proposed studies, novel T cell immunotherapies against breast cancer will be developed based on studies demonstrating a positive correlation between T lymphocytic infiltration of these tumors and a favorable clinical outcome. The major goal of the proposed studies is to isolate and characterize cytolytic T lymphocytes (CTL) with in vivo-like T cell receptors. The CTL provide the basis for adoptive CTL immunotherapy and active immunotherapy with CTL-derived peptides/antigens. During the past 3 months of study approved for inclusion of human subjects, 4 breast carcinoma tissues were cultured in organotypic cultures (reconstructs) and mixed lymphocyte/tumor cultures (MLTC). Eleven T cell lines were obtained from 2 breast cancer specimens and 3 fibroblast cell lines from 3 specimens. The preliminary studies also have shown that breast tumor cells grow in vitro (reconstruct and MLTC), although it is too early to determine the success rate for establishing long-term tumor cell lines. These preliminary studies demonstrate the feasibility of establishing T cell lines against breast cancer cells in a novel culture system with in vivo relevance (reconstruct).

DTIC

Breast; Cancer; Chemoreceptors; Lymphocytes; Mammary Glands; Tissue Culturing

20050200817 Baylor Coll. of Medicine, Houston, TX USA

INT6 is a Potential Tumor Suppressor for Breast Cancer

Chang, Eric; Feb. 2005; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0624

Report No.(s): AD-A435295; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project tests the hypothesis that Int6 regulates the 26s proteasome and acts as a tumor suppressor for breast cancer. The authors have accomplished a key step in this study by generating siRNA sequences that knock down Int6 expression, thus influencing mitosis. They also have prepared a good Int6 antibody and will soon learn whether Int6 associates with the proteasome biochemically. They have made great strides in exploring additional angels to better study Int6 functions. First, they have evidence supporting an intriguing possibility that Int6 may be C-terminally truncated in human breast cancer cell lines. Second, their previous studies of the fission yeast system suggest that the tumorigenesis potential induced by Int6 inactivation can be counteracted by oncogenic Ras. They have further investigated the relationship between Int6 and Ras and found that in fission yeast Int6 can co-localize with the Ras-Cdc42 pathway in the endomembrane. They will determine whether this occurs in human cells and ascertain its role in tumorigenesis.

DTIC

Breast; Cancer; Enzymes; Genes; Mammary Glands; Suppressors; Tumors

20050200818 Wayne State Univ., Detroit, MI USA

Undergraduate Summer Fellowships in Breast Cancer Research

Brooks, Samuel C.; Mar. 2005; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0617

Report No.(s): AD-A435296; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Barbara Ann Karmanos Cancer Institute (KCI) is dedicated to training young scientists for careers in cancer research. The intent of this program is to broaden the number of students that can participate in KCI's undergraduate summer training endeavor by creating a focused effort utilizing the established Breast Cancer Program of their Comprehensive Cancer Center. It is their intent to recruit promising undergraduate science majors, give them the opportunity to take part in breast cancer research, and impress them with the excitement of contributing to the cure/prevention of this dread disease. This summer research fellowship reflects KCI's conviction that elucidation of the biological basis of human cancer and the application of the results from basic research in the clinic requires knowledge and training in many disciplines, including biochemistry, pathology, molecular biology, immunology, therapeutics, pharmacology, and chemistry. The annual goal of this training program is to teach the techniques of bench research, develop within eight students the approach to critical scientific thought needed to pursue independent research, and stimulate the students' desire for a future career in breast cancer research. During the summer of 2004, 8 outstanding undergraduate students from 7 universities were awarded fellowships for training in breast cancer research. The 8 fellows were mentored by 7 individual faculty members (one faculty member mentored 2 fellows in his laboratory) during their training and conducted investigations on a variety of different topics concerned with breast cancer. Studies were carried out in genomic instability, death receptors, apoptosis, differential gene expression, purification of mutant ER alpha, metalloproteinase inhibition, and development of breast cancer vaccines.

DTIC

Breast; Cancer; Education; Mammary Glands; Medical Science; Students; Summer

20050200819 Miami Univ., FL USA

cSrc and Her2 Signaling Pathways Cooperate With Estrogen to Promote Estrogen Receptor Phosphorylation, Ubiquitination and Proteolysis in ER Negative Breast Cancers

Chu, Isabel; Mar. 2005; 48 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0392

Report No.(s): AD-A435298; No Copyright; Avail: CASI; [A03](#), Hardcopy

Oncogenic activation of ErbB2 and cSrc signaling pathways have been associated with worst prognosis and a more aggressive breast cancer phenotype. Here we explored the role of cSrc and ErbB2 as potentially contributing to estrogen receptor (ER) loss in ER protein negative (ER-) breast cancers. Our studies indicate that Src or proteasome inhibition increased ER levels in MCF-7, MDA- MB-361 and BT20. Furthermore, we have shown that Src activation cooperates with ligand to stimulate ER proteolysis and transcriptional activity. GW572016, an ErbB1 and ErbB2 inhibitor, decreased ER transcriptional activity in MCF-7 cells. ER- primary breast cancers and cell lines showed increased Src activity compared to ER+ cancers and cell lines, and the ER protein t1/2 was reduced in ER- breast cancer lines. Thus, these data provide a novel link between

Src activation and the ER- tumor status and support a model whereby Src may promote transcription coupled ER proteolysis in breast cancer cells.

DTIC

Breast; Cancer; Estrogens; Mammary Glands; Phosphorylation

20050200820 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Cellular Effects of Enamel Matrix Derivative Are Associated With Specific Protein Components

Johnson, Dwight L.; May 2005; 112 pp.; In English

Report No.(s): AD-A435300; AFIT-CI04-1123; No Copyright; Avail: CASI; [A06](#), Hardcopy

Emdogain (trademark) or enamel matrix derivative (EMD), is a preparation of matrix proteins derived from developing porcine teeth. Although EMD has been shown to enhance both soft tissue healing and regeneration of the periodontium, the mechanism of this action is still unknown. It is assumed, but not yet proven, that amelogenin, the most abundant protein in EMD, is the protein primarily responsible for the effects of EMD. The purpose of this study was to fractionate EMD and associate specific cellular effects with specific protein components.

DTIC

Enamels; Matrices (Mathematics); Proteins; Teeth

20050200821 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Comparison of Demineralized Dentin and Demineralized Freeze Dried Bone as Carriers for Enamel Matrix Proteins in a Rat Critical Size Defect

Font, Kerri; May 2005; 90 pp.; In English

Report No.(s): AD-A435301; No Copyright; Avail: CASI; [A05](#), Hardcopy

This study evaluated the ability of Emdogain (EMD) in combination with demineralized freeze dried bone (DFDBA) or demineralized dentin matrix (DDM) to enhance bone regeneration as well as the ability of these carriers to maintain EMD at the surgical site. Critical size defects were created in rat calvaria. In Part I of the experiments, varying amounts of EMD (1 mg, 3 mg, 9 mg) with DFDBA or DDM were placed in the defects. DFDBA, DDM, EMD alone, and propylene glycol served as controls (8 rats/group). Rats were euthanized at two and eight weeks. Histological analysis was used to score for the presence of carrier material and new bone formation. The data were analyzed using RIDIT analysis (p%<0.05). In Part II of the experiments, EMD was labeled with 125I and placed in the defect alone or combined with DFDBA or DDM particles. Images were acquired using gamma scintigraphy at 0, 4 hour, 1, 2, 3, 6, 13, 20 days. The images were quantified using computer software to determine the retention of EMD in the critical size defect.

DTIC

Bones; Defects; Demineralizing; Enamels; Freeze Drying; Proteins; Rats; Teeth

20050200822 California Univ., Berkeley, CA USA

Chemotherapeutic Potential of G1 Cell Cycle Inhibitor Indole-3-Carbinol and Its More Potent N-Alkoxy Derivatives in Human Breast Cancer Xenografts in Mice

Kerekatte, Vaishali S.; Firestone, Gary; Aug. 2004; 24 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0176

Report No.(s): AD-A435302; No Copyright; Avail: CASI; [A03](#), Hardcopy

Consumption of cruciferous vegetables has been shown to be associated with decreased incidence of many cancers, including cancer of the breast. Indole-3-Carbinol (I3C), one of the active compounds derived from cruciferous vegetables, has been shown to arrest the growth of hormone responsive and unresponsive breast cancer cells. I3C also has been found to cause increased growth arrest of MCF7 breast cancer cells in the presence of tamoxifen, an anti-estrogen known to cause cell cycle arrest in MCF7 cells. The authors report here that I3C causes a decrease in levels of functional ER alpha, without altering levels of ER beta. Treatment with I3C causes a transcriptional down regulation of ER alpha. It also causes an inhibition of estradiol-inducible gene expression, as well as estrogen-inducible total ERE activity. The authors also demonstrate that levels, subcellular localization, and ERE binding of ER beta remain unaltered.

DTIC

Alkyl Compounds; Breast; Cancer; Chemotherapy; Derivation; Estrogens; Genes; Indoles; Inhibitors; Mammary Glands; Mice; Radicals; Tumors; Vegetables

20050200823 Texas Univ., Arlington, TX USA

Non-Invasive Monitoring for Optimization of Therapeutic Drug Delivery by Biodegradable Fiber to Prostate Tumor
Gu, Yueqing; Feb. 2005; 12 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0229

Report No.(s): AD-A435303; No Copyright; Avail: CASI; [A03](#), Hardcopy

Chemotherapeutic drugs delivered by systematic administration exhibit a great toxicity; patients have to endure the suffering from frequent injection. Thus, chronic and controlled release of chemotherapeutic drugs from biodegradable fibers implanted within the prostate tumor stroma will be a superior treatment modality. Furthermore, non-invasive and real-time monitoring of dynamic response and chronic changes of the tumors to therapeutic interventions will help researchers better understand the therapeutic process, and manipulate and optimize the therapeutic outcome. The hypotheses of this study are as follows: (1) a near-infrared (NIR) imager can noninvasively monitor the dynamic and chronic distribution of chemotherapeutic drug, vascular oxygenation, and blood volume in prostate tumors; and (2) the dynamic response of prostate tumor oxygenation to chronic drug delivery through the biodegradable fibers can serve as an indicator for treatment prognosis. The specific aims of the study were as follows: (1) design and implement an NIR spectroscopic imaging system suitable for dynamic imaging of drug concentrations, tumor oxygenation, and tumor blood volume; (2) develop a 2D tomographic reconstruction algorithm so as to obtain 2D tomographic images of tumor vascular oxygenation and the drug concentration delivered through the biodegradable fibers; (3) load therapeutic drugs onto the biodegradable fibers and control the dosage and releasing rate; and (4) study the relationship among the drug release rate, tumor oxygenation changes, and the therapeutic outcome to obtain optimal conditions in drug delivery.

DTIC

Biodegradability; Cancer; Chemotherapy; Control; Drugs; Infrared Imagery; Prostate Gland; Therapy; Tumors

20050200824 Mount Sinai School of Medicine, New York, NY USA

Increasing Early Detection of Prostate Cancer in African American Men through a Culturally Targeted Print Intervention

Thompson, Hayley; Hall, Simon; Valdimarsdottir, Heiddis; Mar. 2005; 45 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0026

Report No.(s): AD-A435304; No Copyright; Avail: CASI; [A03](#), Hardcopy

Prostate cancer (PCa) incidence and mortality is higher among African American (AA) men compared to all other racial/ethnic groups. There is compelling evidence that the higher mortality is due to the greater likelihood of AA men being diagnosed with advanced-stage PCa. PCa screening, specifically prostate-specific antigen test (PSA) and digital rectal exam (DRE), have been shown to increase early-stage diagnoses. Although several organizations recommend annual PCa screening starting at age 45 for AA men, screening among AA men is low. Indeed, interventions to increase screening and the early detection of PCa among AA men are critical. Although culturally targeted health interventions have been found to be effective, there are no interventions that have systematically addressed culturally relevant factors in PCa screening among AA men. The primary aim of the proposed study is to develop and evaluate the impact of a culturally targeted (CT) print intervention on PCa screening participation among 410 AA men through a randomized controlled trial. The proposed research also seeks to investigate the mediational pathways (i.e., mechanisms) through which the culturally targeted print intervention impacts screening participation. This study is currently awaiting DoD IRB approval, therefore there are no significant findings to report.

DTIC

Africa; Cancer; Detection; Human Beings; Males; Prostate Gland

20050200825 Wayne State Univ., Detroit, MI USA

Synthetic Beta-Lactam Antibiotic as a Selective Breast Cancer Cell Apoptosis Inducer: Significance in Breast Cancer Prevention and Treatment

Dou, Q. P.; Apr. 2005; 78 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0175

Report No.(s): AD-A435305; No Copyright; Avail: CASI; [A05](#), Hardcopy

Activation of the cellular apoptotic program is a current strategy for the prevention and treatment of human cancer, including breast cancer. Because of the ease of synthesis and structural manipulation, small molecules with apoptosis-inducing ability have great potential to be developed into chemotherapeutic drugs. The beta-lactam antibiotics have for the past 60 years played an essential role in treating bacterial infections without causing toxic side effects in the host. The authors hypothesized that active N-thiolated beta-lactams can target a tumor-specific protein or proteins and selectively induce apoptosis in human

breast cancer cells, but not in normal cells. In this summary report, they have designed and synthesized a number of beta-lactams with selected C3 ring substituents, and evaluated the potencies of these synthetic beta-lactams to inhibit proliferation and induce apoptosis in human breast cancer cells. They also are investigating whether these N-thiolated beta-lactams can induce apoptosis selectively in breast tumor vs. normal breast cells. They will study the biochemical target of these N-thiolated beta-lactams by synthesizing and using labeled compounds. Their proposed studies should provide strong support for proof-of-concept of the potential use of these N-thiolated beta-lactams in breast cancer prevention and treatment.

DTIC

Antibiotics; Apoptosis; Breast; Cancer; Chemotherapy; Mammary Glands; Prevention; Target Acquisition

20050200826 Massachusetts General Hospital, Boston, MA USA

Magnetic Resonance Spectroscopy: An Objective Technique for the Quantification of Prostate Cancer Pathologies

Cheng, Leo L.; Feb. 2005; 116 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0190

Report No.(s): AD-A435306; No Copyright; Avail: CASI; [A06](#), Hardcopy

In the past year, according to their proposed Statement of Work, the authors devoted their efforts to the collection of specimens from prostate cancer patients, and spectroscopic and histopathological measurements of these samples for the construction of metabolic markers aimed at tumor diagnosis based on HRMAS 1HMR evaluation. Significant progress has been achieved in these efforts. In the mean time, eight peer-reviewed publications related to the project have been either published, accepted for publication, or put under revision processes. In addition, one NIH RO1 grant has been submitted as a direct result of research activities supported by this award. These advancements will assist them in better understanding tumor metabolism as observed with magnetic resonance spectroscopy, and contribute to better patient treatments in the future.

DTIC

Cancer; Histology; Magnetic Resonance; Markers; Metabolism; Pathology; Prostate Gland; Spectroscopy

20050200827 Texas Univ. Health Science Center, San Antonio, TX USA

Anti-Androgen Receptor RNA Enzyme as a Novel Therapeutic Agent for Prostate Cancer In Vivo

Chen, Shuo; Feb. 2005; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0253

Report No.(s): AD-A435307; No Copyright; Avail: CASI; [A03](#), Hardcopy

Prostate cancer is the second leading cause of cancer death among men in the western world. Androgen plays a crucial role in the development and growth of normal prostate gland and prostate cancer. The action of androgen is mediated by an androgen receptor (AR) and the AR exerts androgen-regulated gene expression. Standard therapy relies on androgen ablation to remove or block the action of androgens. This therapy results in a regression of the tumor because most primary tumor cells depend on androgens for growth and programmed cell death. However, most prostate cancers eventually relapse as their tumors progress to androgen-refractory. Studies have indicated that the AR gene amplification and mutations are involved in androgen-refractory tumors. Therefore, blockage of the AR gene expression may provide a new approach to the management of the AR-dependent cancer. The authors have developed anti-AR RNA enzymes that are able to selectively and specially interact with the AR mRNA and cleave the AR mRNA in vitro. Unlike conventional chemotherapy, the enzymes would have lesser side effects because the compounds selectively destroy only the AR gene. This study proposed to determine the specific efficacy of these enzymes in vivo.

DTIC

Cancer; Chemoreceptors; Enzymes; Gene Therapy; Genes; Hormones; In Vivo Methods and Tests; Males; Prostate Gland; Ribonucleic Acids; Therapy

20050200835 Johns Hopkins Univ., Baltimore, MD USA

Dissecting the Mechanism of T Cell Tolerance for More Effective Breast Cancer Vaccine Development

Ladle, Brian H.; Jaffee, Elizabeth M.; Aug. 2004; 25 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0282

Report No.(s): AD-A435335; No Copyright; Avail: CASI; [A03](#), Hardcopy

T cell tolerance to tumor-associated antigens is a significant barrier to immune based treatments of human cancers. One such tumor-associated antigen is the protooncogene HER-2/neu (neu) which is overexpressed in 35-40% of all human breast cancers. Although patients with neu expressing tumors develop antibody and T cell responses to this antigen, these responses are weak and unable to hinder tumor growth. Our work has focused on understanding these mechanisms of T cell tolerance

using the neu-N transgenic mice that express the wild type rat neu cDNA under control of the MMTV promoter. Since neu is an endogenously expressed antigen, profound neu-specific immune tolerance exists in the neu-N mice. We have characterized the immunodominant T cell epitope of neu recognized by parental FVB/N mice, RNEU420-429. Studying T cell responses to this epitope has yielded important insights into the mechanisms of tolerance in the neu-N mice. Following a neu-targeted vaccine, 100% of FVE/N mice will activate T cells specific to RNEU420-429, whereas RNEU420-429-specific T cells are not activated in the neu-N mice. However, if vaccine is combined with immunomodulatory doses of chemotherapy in neu-N mice, RNEU420-429-specific are now activated in a subset of transgenic mice. Employing MHC tetramer technology, adoptive transfer of RNEU420.429-specific T cells, and T cell activation assays, we have begun to understand the mechanisms of tolerance that prevent the induction of protective immunity against tumors in the neu-N mice and ways to circumvent them. These findings are the basis for a Phase I Clinical Trial now underway at our institution.

DTIC

Antigens; Breast; Cancer; Dissection; Lymphocytes; Mammary Glands; Vaccines

20050200840 Beth Israel Deaconess Medical Center, Boston, MA USA

Tamoxifen Dependent Interaction Between in Estrogen Receptor and a Novel p21 Activated Kinase

Balk, Steven P.; Jun. 2004; 48 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0149

Report No.(s): AD-A435363; No Copyright; Avail: CASI; [A03](#), Hardcopy

The classical estrogen receptor, estrogen receptor alpha (ERalpha) plays an important role in breast cancer development and a large fraction of ERalpha positive breast cancers respond to treatment with tamoxifen. We cloned a novel p21 activated kinase (PAK), termed PAK6, which binds to the androgen receptor (AR) and selectively to the 4-hydroxytamoxifen (OHT) liganded ERalpha. PAKs are a family of serine/threonine kinases that bind to and are regulated by the active (GTP bound) form of the Rho family small (p21) GTPases, Cdc42 and Rac. We found that PAK6 transcripts were expressed in normal mammary epithelium and our preliminary data showed a possible alternative splice product in breast cancer cell lines, indicating that PAK6 may play a role in breast cancer. The purpose of this research was to assess PAK6 expression in breast cancer and to determine whether it contributes to ERalpha function in breast cancer cells or to tamoxifen responses.

DTIC

Breast; Cancer; Estrogens; Mammary Glands

20050200841 Maryland Univ., Baltimore, MD USA

Fibrinolysis in Tumor Associated Angiogenesis

McLeskey, Sandra W.; Jul. 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0311

Report No.(s): AD-A435364; No Copyright; Avail: CASI; [A03](#), Hardcopy

Endothelial cells from different vascular beds, including tumor vasculature, have been shown to have different behavior and different gene expression. In tumors, abundant fibrin in the extracellular matrix dictates that fibrinolytic capability is required for new vessel formation. We have developed an in vitro breast cancer angiogenesis assay using mammary vessels from mice in a 3-dimensional fibrin matrix. Confocal microscopy of these assays is used to quantitate the number of endothelial cells invading the matrix as well as the length of tubular structures formed by the cells. This assay can be used to investigate fibrinolytic molecules important in vascularization of breast tumors.

DTIC

Angiogenesis; Tumors

20050200849 Beth Israel Deaconess Medical Center, Boston, MA USA

Rho GTPase Involvement in Breast Cancer Migration and Invasion

Simpson, Kaylene J.; Mar. 2005; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-O4-1-0360

Report No.(s): AD-A435395; No Copyright; Avail: Defense Technical Information Center (DTIC)

The RhoGTPases play a critical role in cell migration via regulation of cytoskeletal changes. Increased expression of Rho proteins, in particular RhoC, have been associated with invasive carcinoma, however, the functional contributions of the individual isoforms have been difficult to evaluate due to insufficient molecular tools. We used a stable retroviral RNAi approach to abrogate expression of RhoA or RhoC in the SUM-159 invasive breast carcinoma cell line. We observed that loss of RhoA stimulates invasion, resulting in enhanced lamellipodia formation and decreased adhesion to laminin-I. Conversely,

loss of RhoC diminishes invasive potential and impedes cell spreading and lamellipodia formation. A compensatory relationship between RhoA and RhoC at the level of expression and activation was observed and we postulate the reduction in invasive potential for the RhoC siRNA cells results from loss of RhoC expression, as well as increased RhoA activity. Increased invasion in the RhoA siRNA cells results from decreased RhoA and increased RhoC activity but other factors may also contribute based on the use of C3 transferase to inactivate all Rho isoforms. Preliminary in vivo orthotopic studies reveal that RhoC is important for tumour formation while RhoA may regulate the angiogenic response via regulation of VEGF protein expression.

DTIC

Breast; Cancer; Mammary Glands; Migration; Proteins

20050200850 Lankenau Inst. of Medical Research, Wynnewood, PA USA

Suppression of Prostate Tumor Progression by Bin 1

Prendergast, George C.; Feb. 2005; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0177

Report No.(s): AD-A435398; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project seeks to determine the consequences of deleting Bin1, a gene encoding a Myc-interacting adapter protein with features of a tumor suppressor, for normal development or neoplastic transformation of the mouse prostate. In Year 2 of the project, we identified and resolved by use of an alternate strategy a pitfall in the use of the initial knockout mouse strains obtained. Specifically, the Cre-mediated strategy for Bin1 knockout in mouse prostate was found to be inoperational in the strains used. As an alternate approach, we have generated mosaic mice that are heterozygous or nullizygous for Bin1 through the animal, including in the prostate. Mice that are highly mosaic for Bin1 knockout in the prostate are being monitored currently for effects on prostate development and tumorigenesis. Additionally, we crossed an activated Myc allele into the mosaic lineage to generate mice that have sustained Myc lesions and frequent Bin1 knockout in the prostate. These mice are being monitored currently for effects of Bin1 loss on conversion of Myc-induced prostatic intraepithelial neoplasia (PIN) to frank carcinoma.

DTIC

Cancer; Genes; Neoplasms; Prostate Gland; Suppressors; Tumor Suppressor Genes; Tumors

20050200853 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Predicting Outcome in Patients With Work-Related Upper Extremity Disorders: A Prospective Study of Medical, Physical, Ergonomic, and Psychosocial Risk Factors

Huang, Grant D.; Jan. 1999; 119 pp.; In English

Report No.(s): AD-A435410; No Copyright; Avail: Defense Technical Information Center (DTIC)

Work-related upper extremity disorders (WRUEDs) impact workers and work organizations because of the diverse set of medical, psychological legal social and financial challenges that they can present. This impact is further magnified considering that a wide array of individuals can be affected and/or involved with the case. In addition to the worker and management, physicians, occupational/physical therapists, ergonomists, psychologists, as well as co-workers and family members may also be affected by the sequelae of a given WRUED case. Over the past few decades, empirical investigations have found that medical, physical, ergonomic, and psychosocial factors are correlated with and/or predictive of these disorders (e.g., Armstrong et al., 1993; Bongers et al., 1993; Hales & Bernard, 1996).

DTIC

Health; Human Factors Engineering; Medical Services; Patients; Physical Factors; Predictions; Risk; Social Factors

20050200856 Institute for Cancer Research, Philadelphia, PA USA

Integrin-dependent Antagonism of Tamoxifen Therapy through Transcriptional Replacement: Establishing a Basis for a New Combined Therapy

Golemis, Erica A.; Aug. 2004; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0601

Report No.(s): AD-A435428; No Copyright; Avail: Defense Technical Information Center (DTIC)

Accruing evidence suggests that integrin-dependent cell attachment signaling, and estrogen hormonal response are closely interconnected. For example, studies by us and others of the BCAR proteins (BCAR1 and BCAR3: (1, 2)) have indicated that these proteins physically associate with each other, and function both in signal transduction relevant to integrin stimulation, and in mediation of Tamoxifen (Tam) resistance. The goal of this proposal was to explore the interrelationship between

integrin signaling, cell attachment status, and Tam resistance. A specific hypothesis was that activation of integrin signaling reduces the Tam-dependent inhibition of essential estrogen-dependent transcription. In particular, the proposal sought to explore how the formation of organized three-dimensional structures (spheroids) by metastasizing tumor cells, which greatly enhances their resistance to treatment with a number of drugs (reviewed in (4), might modulate Tam resistance and the estrogen-dependent transcriptional program. As described below, we found that spheroids unexpectedly did not result in increased Tam resistance. However, we did find that manipulation of expression of BCAR1 resulted in changes in the transcription of estrogen-regulated genes, suggesting the initial hypothesis of an integrin-estrogen connection at the level of transcription is worth further investigation.

DTIC

Breast; Cancer; Mammary Glands; Therapy

20050200858 Texas Univ., Houston, TX USA

Isolation of Signaling Molecules Involved in Angiogenic Pathways Mediated Alpha v Integrins

Cardo-Vila, Marina; May 2004; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9090

Report No.(s): AD-A435432; No Copyright; Avail: Defense Technical Information Center (DTIC)

Angiogenic vasculature selectively expressed alphavBETA3 and alphavBETA5 integrins but they are not expressed in normal vasculature. They are cell adhesion molecules that play an important role in the regulation of angiogenesis. There are at least two cytokine-dependent pathways that lead to angiogenesis in vivo which can be distinguished by their dependency on specific alphav integrins. Here we aim to define what molecules are involved in ALPHAVBETA3- and alphavBETA5-selective angiogenic signaling. We hypothesize that: i) different molecules associate with each of these integrins after angiogenesis is triggered by defined cytokines; ii) the assembly of specific molecules with the BETA3 or BETA5 cytoplasmic domains results in selective signaling. The strategy used to approach these questions is based on the panning of phage peptide libraries of BETA3 and BETA5 cytoplasmic domains. Selected peptides are used to characterize candidate molecules mimicked by the peptides using biochemistry techniques. Finally, by using micro-injection-based techniques and internalizable forms of the synthetic peptides, we studied the effect of the integrin cytoplasmic domain binding peptides in cell adhesion, migration, apoptosis and proliferation upon stimulation with factors that can activate endothelial cells in vitro. We established that a cell death process induced by BETA5- binding peptide is sensitive to modulation by growth factors and by protein kinase C (PKC), and it cannot be triggered in BETA5 null cells. Finally, we show that the BETA5-binding peptide is a mimic of annexin V. Our results suggest a functional link between the alphavBETA5 integrin, annexin V, and a novel programmed cell death mechanism. These studies will shed light into molecular basis of selective signal transduction pathways initiated by ALPHAVBETA3 and alphavBETA5. New assays aimed to inhibit of angiogenesis, and ultimately, new strategies to treat breast cancer may result from this work.

DTIC

Angiogenesis; Breast; Cancer; Isolation; Mammary Glands; Molecules

20050200859 California Univ., Berkeley, CA USA

Functional Analysis of BORIS, a Novel DNA Binding Protein

Yaswen, Paul; Mar. 2005; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0283

Report No.(s): AD-A435433; No Copyright; Avail: Defense Technical Information Center (DTIC)

BORIS (Brother of the Regulator of Imprinted Sites) is a paralogue of the gene encoding CTCF, a multifunctional DNA binding protein that utilizes different sets of zinc fingers to mediate distinct gene regulatory functions, including those involved in cell growth regulation. Unlike CTCF, the expression of BORIS is normally restricted to specific cells in testes (the only cells where CTCF is not expressed), where it may play a role in reprogramming the methylation pattern of male germ line DNA. To define the possible consequences of aberrant BORIS expression in human breast cancers, we are using a well-characterized human mammary epithelial cell (HMEC) culture model. Our preliminary results suggest that BORIS expression alone is not an efficient immortalizing factor, but that under certain conditions it may cooperate with other changes (e.g. p53 inactivation) to destabilize the genomes of the cells in which it is aberrantly expressed. Since BORIS-eGFP protein sometimes co-localizes with centrosomes, it is possible that BORIS expression can cause genomic instability through aberrant effects on centrosome duplication during the cell cycle. BORIS expression may also cause genomic instability through its significant effects on the regulation of several key early growth response genes.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Functional Analysis; Genes; Mammary Glands; Proteins

20050200862 Johns Hopkins Univ., Baltimore, MD USA

Akt Rescue in Cardiomyocytes but not Breast Cancer Cells after Doxorubicin and Anti-erbB2 Treatment

Gabrielson, Kathleen L.; Apr. 2005; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0541

Report No.(s): AD-A435439; No Copyright; Avail: Defense Technical Information Center (DTIC)

The proposed study will first evaluate the role of Akt, in protection against doxorubicin and anti-erbB2- cardiomyocyte toxicity, using adenoviral expression of active Akt, pharmacological inhibitors of this pathway, and two peptides that activate Akt, cardiotrophin-1 and urocortin. Since these peptides have not been reported expressed in breast tissues or cancer to confirm this, we will evaluate the expression of both peptides and their receptors in six commonly studied breast cancer cell lines and 160 breast cancer tissue arrays by immunohistochemistry and western blotting methods. Even if expression is observed in breast tissue, peptide treatment may improve cancer therapy as seen in other models. In aim 3, the cardiotrophin-1 and urocortin cardiac protection strategy, will be tested against cardiac toxicity induced by doxorubicin, anti-erbB2, chemical inhibitors of erbB1 or erbB2, or combination treatments. This will be a direct comparison of rat and human cardiomyocytes with 6 breast cancer cell lines using MIT assay. Next both peptides, will be administered in pilot studies to Sprague Dawley rats to establish a dose that protects against doxorubicin induced cardiac toxicity. Finally, using a female nude rat breast cancer xenograph model, these peptides will be evaluated for specific cardiac protection, during treatment with doxorubicin, anti-erbB2, combination of doxorubicin and anti-erbB2 and controls. Echocardiography, to evaluate ejection fraction, white blood cell counts, to evaluate bone marrow toxicity, histopathology, xenograph tumor size and weights will be used to assess peptide cardiac specific protection and anti-neoplastic therapy. Doxorubicin is currently a first choice drug for breast cancer treatment, limited in use by its cardiac toxicity. Combination drug treatment is the standard of care.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Mammary Glands; Rescue Operations

20050200863 Cold Spring Harbor Lab., New York, NY USA

Electrophysiological Monitoring of the Interactions between the Serotonin and Dopamine Systems during the Initiation of Goal Directed Behaviors

Mainen, Zachary F.; Apr. 2005; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0027

Report No.(s): AD-A435440; No Copyright; Avail: Defense Technical Information Center (DTIC)

The aim of this project is to record the neural activity of serotonin (5HT) and dopamine (DA) neurons in rats during the performance of a reinforcement learning task. We are interested in how neural activity within these ascending modulatory systems is temporally related to events during learning and decision making. This work will provide a window onto the function of the DA and 5HT systems that is complementary to the rich to existing knowledge from pharmacological and biochemical assays. As there are no studies characterizing the behavior of 5HT neurons during the performance of a behavioral task in any species, a major goal of the work is to identify phasic behavioral correlates of 5HT neural activity. Over the last year, we have overcome many of the technical hurdles associated with recording from 5HT cells in awake behaving animals and in the process have made significant strides towards our goal of characterizing neural activity within the serotonin and dopamine systems during goal directed behavior.

DTIC

Dopamine; Electrophysiology; Serotonin

20050200865 Baylor Coll. of Medicine, Houston, TX USA

Role of Tumor Microenvironment and the FGF Signaling Axis on Differentiation and Emergence of the Neuroendocrine Phenotype in Prostate Cancer

Evangelou, Andreas I.; Feb. 2005; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0291

Report No.(s): AD-A435446; No Copyright; Avail: Defense Technical Information Center (DTIC)

Specific changes in the fibroblast growth factor (FGF) signaling axis can abrogate stromal-epithelial interactions to modify the microenvironment of the prostate gland. We have previously demonstrated that signaling through ECK receptor 1 (FGFR1) but not FGFR2 promoted emergence of epithelial to neuroendocrine transition (ENT) . We have established protocols to introduce constitutively active receptors in prostate epithelial cells and measure expression of genes associated with epithelial (E-cadherin), stromal (Cadherin-11), neuronal (N-cadherin), angiogenic (VE-cadherin), and neuroendocrine (neuron-specific enolase, chromogranin A, and synaptophysin) phenotypes using Real-Time PCR. In determined that TRAMP-C2H, known to be tumorigenic and metastatic, express high levels of FGFRliic in contrast to CIA cells that are not

tumorigenic. Consistent with clinical data C2H cells express very low levels of E-cadherin (1%) when compared to intact mouse prostate. Whereas normal mouse prostate does not express N-cadherin, C2H cells were found to express almost a 1000-fold higher level than CIA and expression of VE-cadherin in C2H was only 1% that of mouse prostate. Interestingly, C2H cells express high levels of Slug, an E-box transcription factor implicated in negative regulation of differentiation-specific markers such as E-cadherin. Ongoing studies are aimed to elucidate the downstream molecular mechanisms that drive emergence of the neuroendocrine phenotype.

DTIC

Cancer; Endocrine Systems; Fibroblasts; Neurophysiology; Phenotype; Prostate Gland; Tumors

20050200867 Jackson (Henry M.) Foundation, Rockville, MD USA

Neuroplasticity and Calcium Signaling in Stressed Rat Amygdala

Li, He; Braga, Maria; Hough, Chris; Manion, Sean; Jiang, Xiaolong; Chen, Aiqin; Gamble, Eleanore H.; Abraham, Preetha; Anderjaska, Vg; Feb. 2005; 166 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0110

Report No.(s): AD-A435451; No Copyright; Avail: Defense Technical Information Center (DTIC)

Posttraumatic stress disorder (PTSD) is a syndrome of symptoms indicative of emotional dysfunction, which develop after exposure to life-threatening events. Prevalent symptoms are exaggerated fear and anxiety, which become particularly intense during exposure to situations reminiscent of the traumatic events that precipitated the disease. The amygdala is a key component of the brain's neuronal network that determines the emotional significance of external events. Despite the central role of the amygdala in emotional behavior, little is known about the impact of stress on the amygdala's function. Clinical evidence indicates that norepinephrine and serotonin may participate in modulating the synaptic plasticity phenomena that result in the memory of frightening events in PTSD. Our data indicate that the modulatory effects of norepinephrine and serotonin receptors on synaptic transmission, neuroplasticity and calcium homeostasis are altered in traumatically stressed rat amygdala. The results of this study may aid in the development of new strategies aimed at modifying and preventing the formation of traumatic memory, and thus could be useful for the treatment of combat PTSD in veterans.

DTIC

Calcium; Rats

20050200875 International Business Machines Corp., Yorktown Heights, NY USA

EPI-SPIRE: A Bio-Surveillance Prototype

Campbell, Murray; May 2005; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-C-0184; Proj-BIOS

Report No.(s): AD-A435473; AFRL-IF-RS-TR-2005-201; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this project was to develop prototype technologies to detect disease outbreak resulting from bioterrorism (biosurveillance) through the analysis of non-traditional data sources. The areas of focus for IBM were: 1. Develop methodologies for evaluating the usefulness of data sources for biosurveillance 2. Identify the most promising data sources for biosurveillance 3. Investigate detection algorithms that can identify early signs of disease outbreak 4. Develop methodologies to evaluate the detection algorithms 5. Develop technologies for protecting privacy of data 6. Investigate site-based biosurveillance. We worked with Greg Glass and his team at the Johns Hopkins School of Public Health. The areas of focus for JHU were: 1. Evaluate the impact of air travel on the dispersion of communicable agents 2. Evaluate selected strategies for early identification of disease outbreaks 3. Develop methods to identify permissive environmental conditions for outbreaks of zoonotic diseases in human populations This report will give overview coverage for all of these areas, and give pointers to the included documents that explore the areas in greater depth. The report will also include a listing of all other documentation for this project, including: PI meeting documents, site visit documents, quarterly reports, and a publication list.

DTIC

Diseases; Prototypes; Surveillance

20050200878 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

A bridge too far

Gamble, Scott; Apr. 2005; 2 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435477; USAMRIID-RPP-05-127; No Copyright; Avail: Defense Technical Information Center (DTIC)

The author of this editorial, Chief, Primate Protocol Support, U.S. Army Medical Research Institute of Infectious

Diseases, Fort Detrick, MD, believes that Dr. Wade Amini is justified in feeling uncomfortable with the protocol. He contends that no protocol, however loosely written, can cover all of the potential animal use concerns that could present themselves in a university setting. The examples provided in this scenario include new surgical procedures, new anesthetic regimens, and a change in species. Most institutions would consider all of these to be major changes.

DTIC

Animals; Medical Science; Protocol (Computers); Regulations

20050200880 Texas Univ. Health Science Center, San Antonio, TX USA

Development of Anti-Cancer Therapeutics That Modulate the RAD51-BRCA2 Complex

Hasty, Edward P.; Mar. 2005; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0587

Report No.(s): AD-A435492; No Copyright; Avail: Defense Technical Information Center (DTIC)

Cancer is one of the leading causes of death in America and breast cancer is particularly threatening for women. In America 10% of women will be diagnosed with breast cancer resulting in the death of more than 40,000 of these women each year. Inheriting a single defect in genetic material causes about 5% of the cases of breast cancer. A gene that is commonly mutated in these inherited cases of breast cancer is called BRCA2 (Breast Cancer susceptibility gene). BRCA2 is called a tumor suppression gene because its function is essential for preventing cancer, as a result deletion of this function predisposes women to breast cancer. BRCA2 is important for repairing damage to genetic material, DNA, by virtue of its association to RAD51. The BRCA2-RAD51 complex repairs broken DNA and disruption of this interaction may predispose a woman to breast cancer. This work defines the RAD51-Brc2 interaction.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Mammary Glands

20050200886 American Registry of Pathology, Washington, DC USA

New Approaches for Early Detection of Breast Tumor Invasion or Progression

Man, Yan-Gao; Aug. 2004; 206 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0129

Report No.(s): AD-A435499; No Copyright; Avail: CASI; [A10](#), Hardcopy

The epithelium of normal and non-invasive human breast tumor tissues is physically separated from the stroma by the basement membrane and a layer of myoepithelial (ME) cells, whose degradation is a pre-requisite for tumor invasion. Our previous studies revealed that a subset of estrogen receptor (ER) positive in situ breast tumors contained focally disrupted ME cell layers, which were overlaid exclusively or preferentially by ER negative cell clusters. Our current studies further show that, compared to adjacent ER positive cells within the same duct, these cell clusters have several unique features: 1 a significantly higher proliferation rate; 2 a substantially different frequency and pattern of genetic alterations; 3 a significantly higher expression level and frequency of tumor progression and invasion related genes. Together, our findings suggest that these cell clusters may represent the direct precursor of invasive lesions, and the development of specific antibodies or chemical agents to target these cells might provide a more sensitive and less toxic approach to treat and prevent breast tumor invasion.

DTIC

Breast; Cancer; Detection; Epithelium; Estrogens; Mammary Glands; Tumors

20050200887 National Rehabilitation Hospital, Washington, DC USA

Assistance Technology Research Center

Toerge, John; Rosen, Michael; Bleiberg, Joseph; Feb. 2003; 42 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0056

Report No.(s): AD-A435500; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Assistive Technology Research Center, ATRC, is comprised of a set of interrelated research and development projects which apply modern technologies, in particular those which have been exploited in the military, to the practice of medical rehabilitation and technological support for independent living for individuals with disabilities. The Center seeks to work collaboratively to meet the particular mandates of the U.S. Army Medical Research and Materiel Command. Projects are physically conducted and administratively located in the departments of rehabilitation engineering and neuroscience at the National Rehabilitation Hospital. Individual researchers from several other hospital services and clinical professions are also involved. The ATRC takes advantage of a unusual combination of skills, facilities and interests; specifically a strong

community of R&D specialists in biomedical engineering and neuropsychology is positioned to undertake collaborative projects unlike those under way at more conventionally staffed laboratories. The projects whose progress is detailed in this report target the needs of individuals with head injury, stroke, spinal cord injury and developmental disabilities. These activities address the clinical techniques of psychologists, occupational and physical therapist, physicians and speech pathologists. They make use of technologies based particularly in software development but also in man-machine systems, human factors, biomechanics, telehealth, virtual reality methods, and instrumentation. Assessment and enhancement of motor and cognitive function; and support and measurement of functional performance are the prevailing research themes.

DTIC

Biodynamics; Disabilities; Therapy

20050200888 State Univ. of New York, Geneseo, NY USA

Investigation of a Sybr-Green-Based Method to Validate DNA Sequences for DNA Computing

Pogozelski, Wendy; Priore, Salvatore; Bernard, Matthew; Macula, Anthony; May 2005; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-2-0218; Proj-DNAL

Report No.(s): AD-A435503; AFRL-IF-RS-TR-2005-205; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project validated the generation of DNA sequences called a DNA (n,d) code. Fifteen strands of 16 nucleotides each were designed such that a code strand would hybridize only with its reverse-complement and would not cross-hybridize or miss-pair with any other strand in the set. The code was designed using principles from nearest-neighbor studies and the thermodynamics of base stacking. All possible combinations of strands were tested for their potential to miss-pair. Hybridizations of the sequences representing junctions of strands were also tested. Strands were tested for their potential to cross-hybridize by measuring fluorescence over varying temperatures in the presence of SYBR Green. Strands were tested in pools to show that hybridization between Watson-Crick complements is still thermodynamically favorable even when all strands are present. Nearly all twenty strands and 56 junction sequences showed suitable preference for their direct complement and did not appreciably miss-pair with any other strand in the code. The general properties and modes of binding of SYBR Green I were explored. The experiments indicate that SYBR Green I is positively-charged and binds to DNA predominantly via electrostatic interactions and groove binding. Its fluorescence increases with the number of base pairs in a predictable manner.

DTIC

Deoxyribonucleic Acid; Sequencing; Thermodynamics

20050200889 Veterans Medical Research Foundation, San Diego, CA USA

The Effects of Total Sleep Deprivation and Recovery Sleep on Cognitive Performance and Brain Function

Drummond, Sean P.; Aug. 2004; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0201

Report No.(s): AD-A435504; No Copyright; Avail: CASI; [A03](#), Hardcopy

An ever-increasing number of military personnel and civilians alike must work daily without adequate sleep. Although considerable data show that sleep deprivation alters many aspects of behavior, little is known about changes in the brain substrate underlying the behavioral effects. Even less is known about the cerebral effects of recovery sleep. The overarching objective of this study is to investigate the effects of 2 full nights of sleep loss and 2 full nights of recovery sleep on cognitive performance and brain function. We will study 40 individuals for 6 nights and 6 days. Subjects will receive 4 polysomnograms and 10 functional magnetic resonance imaging (fMRI) sessions. During the fMRI sessions, functional brain imaging data will be collected while subjects perform each of 3 cognitive tasks: sustained attention, arithmetic working memory, and verbal learning. Thus far, 17 subjects have completed the protocol. While these data are preliminary, there are indications that this study will help identify the rate at which performance on different cognitive tasks deteriorates with sleep loss and recovers with subsequent sleep. Furthermore, we may be able to advance our understanding of the brain function correlates of individual differences in vulnerability and resilience to sleep deprivation.

DTIC

Brain; Imaging Techniques; Magnetic Resonance; Mental Performance; Sleep; Sleep Deprivation

20050200891 New Mexico Univ., Albuquerque, NM USA

Identification of the Types, Properties, and Functional Characteristics of Telomerase Expressing Cells in Breast Cancer

Hines, William C.; Griffith, Jeffrey K.; May 2004; 19 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0514

Report No.(s): AD-A435507; No Copyright; Avail: CASI; [A03](#), Hardcopy

The aims of this study are to identify the types and properties of telomerase producing cells within breast tumors, and further, to isolate these cells from breast tumors so that their biochemical and functional properties may be characterized. Through examining the role of telomerase in cancer, this project also fosters the education of the candidate through the interaction with several experts in breast cancer pathology, epidemiology, biostatistics, and clinical and basic research. The experiments involved require the interaction with professionals from several different fields of the biomedical sciences and the mastery of several challenging laboratory techniques. To date, all tasks, as outlined in the Statement of Work, are on schedule. The research is in progress.

DTIC

Biochemistry; Breast; Cancer; Mammary Glands; Neoplasms; Ribonucleic Acids; Tumors

20050200893 Wayne State Univ., Detroit, MI USA

Lymphedema Prophylaxis Utilizing Perioperative Education

Kosir, Mary A.; Sep. 2004; 34 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0495

Report No.(s): AD-A435510; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose is to evaluate perioperative training for lymphedema protection. The hypothesis is that structured perioperative training in lymphedema protection will decrease lymphedema, and improve the QOL in patients undergoing axillary dissection and/or radiation therapy for breast cancer as compared to a control group. The specific questions are 1) what is the incidence of lymphedema and infection during the first three years after surgery among breast cancer patients who received perioperative training in lymphedema protection as compared to a control group? 2) What are the differences in the measured QOL among these breast cancer survivors? 3) What are the retention of information on lymphedema protection, and the compliance with arm precautions among these breast cancer survivors? Major Findings: In this interim report, the LE rate is 55%. Our rate for acute LE is 46.2%. Presentation of LE after the first year after surgery occurred in 8.9% of the study patients. There were 38. 6% acute LE cases persisting to become chronic for a total chronic rate of 47. 5%. Significance: LE is a significant problem. The identification of newer treatment plans and modalities that may obviate the need for injury to the lymphatics would help reduce the incidence of LE.

DTIC

Education; Health; Lymphatic System; Prophylaxis

20050200902 Minnesota Univ., Minneapolis, MN USA

Image-Guided Surgery of Primary Breast Cancer Using Ultrasound Phased Arrays

Ebbini, Emad S.; Jul. 2004; 20 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0330

Report No.(s): AD-A435536; No Copyright; Avail: CASI; [A03](#), Hardcopy

High-intensity focus ultrasound (HIFU) is gaining wider acceptance in noninvasive or minimally invasive targeting of abnormal tissues (e.g. cancer) for destruction. Piezocomposite transducer technology, especially for phased arrays, is providing high-quality HIFU applicators with increased bandwidth and reduced parasitic cross coupling between the array elements. In addition to increasing the efficacy of HIFU applicators, these technological enhancements allow for the use of HIFU arrays in imaging the target region before, after, and intermittently during lesion formation. This leads to a unique paradigm of image-guided surgery with HIFU in which the coordinate systems for both therapy and imaging are inherently registered. This project investigates the feasibility of using piezocomposite phased arrays as dual-mode ultrasound array (DMUA) applicators for the noninvasive treatment of primary breast cancers. Both therapeutic and imaging capabilities of the dual-mode arrays are investigated leading to a real-time dual-mode array system to be used in pursuing in vivo animal experiments in the future.

DTIC

Breast; Cancer; Mammary Glands; Medical Equipment; Phased Arrays; Surgery; Ultrasonics

20050200904 Arkansas Univ. for Medical Sciences, Little Rock, AR USA
Maximizing Immune Response to Carbohydrate Antigens on Breast Tumors
Kieber-Emmons, Thomas; Aug. 2004; 31 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0366
Report No.(s): AD-A435539; No Copyright; Avail: CASI; [A03](#), Hardcopy

Tumor antigens are autologous antigens and thus are weakly immunogenic. Unresponsiveness appears to be related to suppression of antigen specific helper T cell function which can be overcome by providing heterologous help. Carbohydrates are richly expressed on the surface of many cancers, at frequencies higher than oncogene products. Consequently, tumor associated carbohydrate antigens, are in principle, excellent targets for immunotherapy. However, carbohydrates are generally poor at eliciting effective antibody responses and rarely provide target epitopes for CTL because of their T cell-independent nature. The major objective of this application is to examine ways to maximize the tumor-protective immunity directed to carbohydrate antigens expressed on breast tumors. Towards this end we are developing peptide mimotopes of tumor associated carbohydrate antigens as they are T cell dependent antigens. In our progress to date we have shown that 1.) We observed that transfection with Fut 3 changes the expression profile of E selectin reactivity. 2) We defined potential peptide mimotopes for targeting 4T1 cells in vivo. 3) We observed that immunization with DNA induced IgM antibodies reactive with 4T1 cells. 4) We observed that DNA administration of 4T1-tumor bearing animal temporarily reduces the burden of tumor. 5) DNA administration of the 107 peptide significantly increases survival rate of animals. 6) We observed that administration of 107 DNA inhibits liver metastases.

DTIC

Antigens; Breast; Cancer; Carbohydrates; Immunity; Immunology; Mammary Glands; Physiological Responses; Tumors

20050200905 Indiana Univ., Indianapolis, IN USA
Regulatory Control of Breast Tumor Cell Poly (ADP-Ribose) Polymerase
Abdel-Aziz, Waleed; Milkas, Linda; Aug. 2004; 36 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0324
Report No.(s): AD-A435540; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have previously isolated an intact, stable, and fully functional multiprotein DNA replication complex (designated the DNA synthesize) from a variety of non-malignant and malignant tumor cells and tissues including breast cancer cells. We have also shown that poly(ADP-ribose) polymerase (PARP) is among the components of the DNA synthesize. The transformation of a non-malignant human cell to a malignant state is accompanied by a significant alteration in the mobility of specific components of the DNA synthesize, (such as PCNA) following 2D-PAGE analysis of the DNA synthesize, together with a 4-6-fold decrease in the replication fidelity of the replication complex. In order to establish whether the malignant transformation process is accompanied by an alteration in PARP, we purified PARP from malignant and non-malignant breast cells using phosphocellulose and hydroxylapatite chromatography. When analyzed by 2D SDS-PAGE, PARP isolated from the two cell lines showed a difference in the electrophoretic migration pattern. The enzyme present in non-malignant breast cells had a basic pI and was resolved as a single spot; however, malignant breast cell PARP appeared as a basic spot in addition to less abundant species having less basic pI values. The altered PARP isoforms were detected both in estrogen-dependent (MCF-7) and non-estrogen-dependent (MDA MB-468) cells. In addition, these isoforms were detected in ovarian cancer cell line PA-1. We have also found that PARP from malignant breast cells has different kinetic properties (Km and Vmax) than those of non-malignant PARP. Moreover, nuclear proteins in malignant and non-malignant breast cells are differentially POLY(ADP-ribosylated). The results presented in this report suggest that PARP might have a different role during malignancy.

DTIC

Breast; Cancer; Cells (Biology); Mammary Glands; Ribose; Ribosomes; Tumors

20050200908 Macula (Anthony J.), Genesee, NY USA
Encoding Cooperative DNA Codes
Macula, Anthony J.; May 2005; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-C-0059; Proj-EIDN
Report No.(s): AD-A435544; AFRL-IF-RS-TR-2005-195; No Copyright; Avail: Defense Technical Information Center (DTIC)

The primary goal of this research was the development of an enabling technology for DNA computing. It is focused on the construction of a biomolecular architecture designed to employ new algorithmic paradigms based on the massively parallel computational power of DNA hybridization. The intent is to develop a computing basis to eventually overcome the exponential

time complexity of many discrete math problems so that they can be solved in linear real time. Many of these computationally hard (NP) problems are critical to logistics scheduling and security. In this way, this research addresses computational, national security and knowledge acquisition challenges of the Air Force. DNA code words are structural and information building blocks in biomolecular computing and other biotechnical applications that employ DNA hybridization assays. Thermodynamic distance functions are important components in the construction of DNA codes. We introduce new matrices for DNA code design that captures key aspects of the nearest neighbor thermodynamic model for hybridized DNA duplexes. One version of our metric gives the maximum number of stacked pairs of hydrogen bonded nucleotide base pairs that can be present in any secondary structure in a hybridized DNA duplex without pseudo knots. We introduce the concept of (t-gap) block isomorphic subsequences to describe new string metrics that are similar to the weighted Levenshtein insertion-deletion metric. We show how our new distances can be calculated by a generalization of the folklore longest common subsequence dynamic programming algorithm. We give a Varshamov-Gilbert like lower bound on the size of some of codes using our distance functions as constraints. We also discuss software implementation of our DNA code design methods.

DTIC

Algorithms; Assaying; Coding; Deoxyribonucleic Acid

20050200910 Texas Univ., Dallas, TX USA

Critical Contribution of Ral GTPases to Growth and Survival of Breast Cancer

Chien, Yuchen; Apr. 2005; 23 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0389

Report No.(s): AD-A435549; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have previously identified the Ras-like GTPases, RalA and RalB as linchpin modulators of human tumor cell proliferation and survival. Using RNAi-mediated loss-of-function analysis, we find that RalA is critical for anchorage-independent growth whereas RalB is required for tumor cell survival. The collaboration of these isoform-specific contributions generates a minimal oncogenic platform, which results in aberrant proliferation coupled with suppression of apoptosis. We have begun to characterize the molecular basis of the collaborative contributions of RalA and RalB to cell regulation. These studies have surprisingly revealed that RalB and Sec5 are mediating tumor cell survival whereas RalA and STAT3 contribute to anchorage-independent proliferation. Understanding how the regulation occurs will be the focus of my future work.

DTIC

Apoptosis; Breast; Cancer; Mammary Glands; Survival

20050200913 Burnham Inst., La Jolla, CA USA

Molecular Mechanisms of Hormone-Refractory Prostate Cancer

Vuori, Kristiina; Feb. 2005; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0032

Report No.(s): AD-A435559; No Copyright; Avail: CASI; [A03](#), Hardcopy

The concept to be tested herein is that the various tyrosine kinase pathways known to contribute to anti-androgen resistance likely converge on a common signaling molecule that integrates the upstream signaling input and leads to androgen receptor activation in an androgen-independent manner. Identification of the signal-integrating molecule(s) would provide a valuable therapeutic target for prostate cancer. We hypothesized that the intracellular docking protein Cas, complexed with the adapter protein Crk, could have such a signal-integrating role. Our studies performed so far support a role for Crk in androgen resistance signaling pathways. At the same time, our studies suggest that a docking molecule other than Cas, but possessing a similar molecular weight, functions to couple Crk to the upstream tyrosine kinases. Thus, we have established a correlation between androgen independence and Ork signaling, as proposed in the aim 1 of our application. Our next objective is to molecularly identify the signal integrating docking molecule, and then proceed to aim 2 and examine whether activation of Crk signaling is causal to androgen independence in prostate cancer cells in vitro. Our long-term objective is to utilize the obtained information to develop specific and sensitive tools for diagnosis and therapeutics of anti-androgen resistance.

DTIC

Cancer; Hormones; Molecular Properties; Prostate Gland; Refractories; Refractory Materials

20050200914 Pennsylvania Univ., Philadelphia, PA USA

Identification of Novel Molecular Targets for Pleckstrin Homology (pH) domains Found in Oncogenes Implicated in Breast Cancer

Keleti, David; Mar. 2005; 56 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0320

Report No.(s): AD-A435560; No Copyright; Avail: CASI; [A04](#), Hardcopy

Pleckstrin Homology (PR) domains are commonly thought of as membrane-targeting modules involved in signaling pathways that bind phosphoinositides with high affinity and specificity. In a recent study of all PH domains in *S. cerevisiae*, only one bound PI(4,5)P2 with high affinity and specificity, while another six bound 3- phosphoinositides with moderate affinity and promiscuity; the remainder showed little or no affinity or specificity for phosphoinositides (Yu et al, 2004). All human PH domains were subdivided into 66 phylogenetic classes, and a 'class representative' selected for in vitro phosphoinositide binding (21 completed) and in vivo localization studies (43 completed). The results are comparable to the yeast study, with only one confirmed high affinity and PI(4,5)P2-specific and several moderate affinity and promiscuous PH domains, while the remainder are low affinity and promiscuous. As in yeast, several low-to-moderate affinity and promiscuous PR domains showed plasma membrane or punctate localization. Two PR domains of this class possess comparable affinities for Golgi- and plasma membrane-enriched phosphoinositides in vitro, although they both localize to the Golgi, not the plasma membrane in vivo. Additionally: * A moderate affinity, PI(3,4)P2-specific PR domain was identified. An alkylphospholipid drug was found to selectively target a PH domain in vitro.

DTIC

Breast; Cancer; Carcinogens; Domains; Homology; Mammary Glands; Oncogenes; pH; Targets; Tumors; Viruses

20050200918 California Univ., Irvine, CA USA

A Target for Breast Cancer Prevention and Treatment

Blumberg, Bruce; Apr. 2005; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0323

Report No.(s): AD-A435565; No Copyright; Avail: CASI; [A03](#), Hardcopy

Anti-estrogens such as tamoxifen are important therapeutics for treatment and chemoprevention of breast cancers. Other compounds such as phytoestrogens and fatty acid amides are also effective against breast cancer proliferation. These compounds share the ability to activate the steroid and xenobiotic receptor (SXR). Our hypothesis is that SXR serves as a common molecular target for the anti-proliferative effects of these compounds and activation of SXR is itself anti-proliferative. We have detected SXR protein in breast cancer cell lines, and have shown that either SXR activators or a constitutively active form of SXR are able to slow the proliferation of breast cancer cells. We found that SXR activators share the ability to increase the expression of inducible nitric oxide synthase in MCF-7 cells leading to an increased production of reactive nitrogen species. In SXR activator treated cells, we found that p53 expression as well as the p53 target genes p21 and BAX were increased. Apoptosis occurred in cells treated with SXR activators and is likely the reason for the observed decrease in cell proliferation. Activated/stabilized p53 due to cellular stress from increased reactive nitrogen species provides a mechanism explaining the apoptotic response and decreased proliferation in the presence of SXR activators.

DTIC

Amides; Breast; Cancer; Fatty Acids; Mammary Glands; Prevention; Proteins; Steroids; Suppressors; Targets

20050200920 Baylor Coll. of Medicine, Houston, TX USA

Inhibition of Her2 Transcription by Small Organic Molecules

Choi, Yongmun; Uesugi, Motonari; Apr. 2005; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0277

Report No.(s): AD-A435567; No Copyright; Avail: CASI; [A02](#), Hardcopy

Overexpression of the Her2 protein has been found in 30% of breast tumors, and the inhibition of Her2 expression may be an effective way to treat Her2-positive patients. Recently, the P.I. and co-workers reported identification of chemical inhibitors of Her2 transcription. The compounds that we named adamanolol and wrencholol inhibited Her2 transcription by disrupting the interaction of two cancer-linked nuclear proteins, ESX and Sur-2. Affinity purification revealed that wrencholol binds to the Sur-2 subunit of the human mediator complex by mimicking the potent activation domain of transcription factor ESX. In the third year of finding, we designed a STF1 (synthetic transcription factor), taking advantage of the ability of wrencholol to bind to the Sur-2 subunit and the specific DNA-binding affinity of a hairpin polyamide molecule. The hybrid compound of these two molecules activated transcription of a reporter gene in vitro in a promoter-dependent manner through simultaneous contacts with DNA and Sur-2. Our results indicate that wrencholol serves as an activation domain mimic, and that it is possible to generate a transcription factor out of completely organic components.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Mammary Glands; Molecules

20050200935 Kansas Univ., Kansas City, KS USA

Inhibition of Androgen-Independent Growth of Prostate Cancer by siRNA-Mediated Androgen Receptor Gene Silencing

Li, Benyi; Feb. 2005; 47 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0214

Report No.(s): AD-A435609; No Copyright; Avail: CASI; [A03](#), Hardcopy

To develop a novel therapeutic approach for hormone-refractory prostate cancers, we proposed to knock down human androgen receptor (AR) gene using an RNAi-based technique. Based on our previous work, we generated a recombinant adeno-associated virus bearing a hairpin-structured small interfering RNA against the AR (ARHP8) for long-term expression of the AR siRNA. A control virus bearing the GFP gene only was also produced. We demonstrated that the resultant rAAV.ARHP8 knocked down the AR expression both in protein and mRNA levels in prostate cancer LNCaP cells. Next, we will use the virus to treat prostate cancer xenografts in a nude mice model.

DTIC

Adenoviruses; Cancer; Hormones; Males; Prostate Gland; Ribonucleic Acids

20050200936 Finch Univ. of Health Sciences/Chicago Medical School, Chicago, IL USA

Emotional Expression and Psychological Adjustment to Prostate Cancer: A brief Intervention for Patients and Their Partners

Zakowski, Sandra G.; Feb. 2005; 39 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0017

Report No.(s): AD-A435610; No Copyright; Avail: CASI; [A03](#), Hardcopy

The current study examines the effects of a psychological intervention that encourages emotional expression in prostate cancer patients and their partners. Prostate cancer patients (n=130) and their partners are randomly assigned to an intervention or a control group. Following Pennebaker's model, subjects in the intervention group are asked to write, about their deepest thoughts and feelings regarding their cancer experience for 20 minutes each day for three consecutive days. The control group is asked to write about trivial non-emotional topics. Outcome variables including psychological distress, quality of life, and physical symptoms is assessed at baseline and over a period of nine months after the intervention (one week, three, six, and nine months) In accordance with our approved Statement of Work data collection is currently underway. To date 260 subjects have been enrolled and are at various stages of the data collection process. Data processing is continuing as planned, including data entry and verification, which has been completed for all subjects currently enrolled in the project. Preliminary data analyses are being conducted.

DTIC

Cancer; Emotional Factors; Patients; Prostate Gland; Social Factors

20050200938 Alabama Univ., Birmingham, AL USA

A Controlled Trial of Chemoprevention Using COX-2 Inhibitors in an Avian Model of Spontaneous Ovarian Carcinogenesis

Barnes, Mack N.; Berry, Wallace D.; Mar. 2005; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0322

Report No.(s): AD-A435613; No Copyright; Avail: CASI; [A02](#), Hardcopy

While a strong rationale for chemoprevention of ovarian carcinoma exists, a mechanism for the comprehensive evaluation of novel compounds is severely impeded by the lack of a validated animal model of spontaneous ovarian carcinogenesis. At present, there is no verified, established model for this disease. In rodents, this type of cancer does not spontaneously develop. While studies investigating 'induced' carcinomas have been performed they are hindered by biologic differences in induced and spontaneous tumor formation. Identification of spontaneous ovarian carcinogenesis in the laying hen (*Gallus Domesticus*) may provide the answer to this dilemma. Multiple reports have demonstrated a 30-50% rate of spontaneously arising genital tract adenocarcinomas in hens of 3-6 years of age. Thus, the purpose of this study will be to utilize this animal model to evaluate the ability of a COX-2 inhibitor to reduce the incidence of spontaneous ovarian carcinogenesis in this animal model. More importantly, identification of promising agents in surrogate animal models that simulate a high risk population would significantly impact the strategy of cancer chemoprevention for ovarian carcinoma and lead to subsequent endeavors in this neglected area of study.

DTIC

Birds; Cancer; Carcinogens; Inhibitors; Ovaries; Prevention

20050200940 Texas Univ., Austin, TX USA

In Vivo Fluorescence Confocal Microscopy to Investigate the Role of RhoC in Inflammatory Breast Cancer

Hoffmeyer, Michaela; Apr. 2005; 39 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0391

Report No.(s): AD-A435616; No Copyright; Avail: CASI; [A03](#), Hardcopy

Inflammatory breast cancer (IBC) is a highly aggressive form of breast cancer characterized by a dermal inflammatory-like presentation. This phenotype maybe due to a unique method of invasion not well characterized. We have made considerable progress in investigating whether RhoC expression plays a role in the unique phenotype of IBC. Bicistronic red fluorescent protein (RFP) expression vectors containing mutant forms of Rho proteins have been successfully constructed and stable IBC and control breast cancer cell line selection is underway. In vitro analysis, submitted for publication, of the SUM 149 (IBC) and the SUM 102 (non-IBC) cell lines has revealed reduced invasion and adhesive capacity to basal lamina components by the IBC cell line, possibly suggesting a passive mode of IBC dissemination. Stably expressing RFP IBC and RFP MDA-MB-435alpha6HG6 breast cancer cell lines have been constructed and used successfully in the optimization of a macroscopic fluorescence imaging system for utilization in determining tumor take, monitoring tumor growth, and locating sites of invasion for imaging with our confocal in vivo fluorescence microscope. Finally, construction of the in vivo fluorescence confocal microscope is in process with our collaborators.

DTIC

Breast; Cancer; Fluorescence; In Vivo Methods and Tests; Mammary Glands; Microscopy; Proteins

20050200943 Dana Farber Cancer Inst., Boston, MA USA

Genome-Wide Nucleic Acid/Protein Interaction in Breast Cancer

Silver, Pamela A.; Apr. 2005; 86 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0364

Report No.(s): AD-A435620; No Copyright; Avail: CASI; [A05](#), Hardcopy

Since many types of breast cancer remain untreatable, the research proposal aims to develop novel genomic technology to identify potential therapeutic targets and to aid in diagnosing various types of breast cancer at the molecular level. The overarching goal of the proposal is to develop a technology to screen nucleic-acid protein interactions on a genome scale with a focus on understanding complexes involved in breast cancer. In order to identify the regulatory networks of interactions between RNAs and proteins, we proposed to develop a rapid genome-scale method to determine the specific RNA targets and RNA binding sites of proteins. The aims were to 1) discover RNA targets of specific RNA binding proteins and 2) define the RNA sequences recognized by proteins using novel nanotechnologies including development of optically encoded beads containing both a unique optical signature and a specific oligonucleotide. This technology is being complemented by genome-wide chromatin immunoprecipitation and RNA profiling on exon arrays. Progress during the past year has been made on Aims 2, 3 and 4 of the original grant as detailed below. Two papers mapping proteins to the genome have been submitted for publication while a third paper is in preparation.

DTIC

Breast; Cancer; Genome; Mammary Glands; Nucleic Acids; Proteins

20050200945 San Diego State Univ., San Diego, CA USA

Supporting the Virtual Soldier With a Physics-Based Software Architecture

Impelluso, Thomas J.; Jun. 2005; 34 pp.; In English

Contract(s)/Grant(s): W81XWH-04-2-0010

Report No.(s): AD-A435627; No Copyright; Avail: CASI; [A03](#), Hardcopy

This effort researched a new methodology to integrate the modules of mechanics to support digital organ geometries of the virtual soldier. Specifically, this effort researched a computational methodology to solve for the problems of flexible multi-body dynamics. This methodology can readily be extended to multi-phase and multi-scale problems in general to support organ geometries. Rather than presenting a new theory, a new algorithm or a new software package, this effort introduces a methodology so that researchers in mechanics can deploy their preferred algorithms or theorems in a new way to solve such problems by building up a preferred solution method from the fundamental technologies of the cyber-infrastructure. The approach advocated in this phase 1 testbed is: fault tolerant, extensible and scaleable.

DTIC

Computer Programming; Software Engineering

20050200947 Texas A&M Univ., College Station, TX USA

Disaster Relief and Emergency Medical Services (DREAMS): Texas A&M Digital EMS and the Detection and Remediation of Chemical Threat Agents

Ewing, Richard E.; Flournoy, Larry; Wall, Jim; Wild, Jim; Crooks, Richard; Raushel, Frank; Gabbai, Francois; Young, Ryland; Oct. 2004; 36 pp.; In English

Contract(s)/Grant(s): DAMD17-00-2-0010

Report No.(s): AD-A435629; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Disaster Relief and Emergency Medical Services (DREAMS trade mark) project is a consortium of scientists, medical professionals, and engineers from The Texas A&M University System and the University of Texas Health Science Center at Houston. The goal of DREAMS is to improve the diagnosis and treatment of critically ill or injured soldiers in the field by expediting their access to medical experts at trauma centers or field hospitals.

DTIC

Disasters; Emergencies; Medical Services; Military Operations

20050200949 Michigan Univ., Ann Arbor, MI USA

Discovery and Test of Small Molecule Inhibitions of XIAP as Potential Novel Therapy for the Treatment of Breast Cancer

Lu, Yipin; Apr. 2005; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0351

Report No.(s): AD-A435631; No Copyright; Avail: CASI; [A02](#), Hardcopy

The inhibitors of apoptosis protein (IAP) are intrinsic cellular negative regulators of apoptosis. The X-linked inhibitor of apoptosis protein (XIAP) is a potent caspase inhibitor in IAP family, which is highly expressed in most of the widely studied breast cancer cell lines. The mitochondrial protein Smac is a negative regulators of XIAP that competitively binds to a binding pocket on the BIR3 domain of XIAP and disrupts caspase-9 binding to XIAP. Using the 3D structure of XIAP, we have performed a structure-based database screening of large chemical databases and discovered several non-peptide small molecule inhibitors of XIAP. The most potent compound among them, SMXI-56, binds to the XIAP BIR3 protein with an affinity similar to that of the natural Smac peptide in a fluorescence polarization-based binding assay. The NMR HMQC analysis confirmed that SMXI-56 interacts with several crucial residues in the XIAP BIR3 domain where Smac and caspase-9 bind. SMXI-56 inhibits cell growth and induces apoptosis in breast cancer cells with high levels of XIAP, but has a minimal effect on normal breast cells with low levels of XIAP. This work demonstrates that the virtual database screening combined with biological activity tests can identify potential inhibitors of XIAP for treatment of breast cancer.

DTIC

Apoptosis; Breast; Cancer; Mammary Glands; Therapy

20050200950 Burnham Inst., La Jolla, CA USA

Cas Signaling in Breast Cancer

Vuori, Kristina; May 2005; 18 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0523

Report No.(s): AD-A435633; No Copyright; Avail: CASI; [A03](#), Hardcopy

Resistance to antiestrogens is a serious clinical problem in breast cancer treatment, and a better understanding of the mechanisms of antiestrogen resistance is urgently needed. Our hypothesis, which is supported by our preliminary data, is that the signaling molecule Cas- has an important causal role in the development of antiestrogen resistance. As a corollary, understanding of the pathways that Cas activates may identify key regulators of antiestrogen resistance and novel targets for breast cancer treatment, and measurements of Cas signaling levels may provide useful prognostic information for breast cancer patients. Our objective is to test our hypothesis, and to identify the signaling pathways that mediate Cas-induced antiestrogen resistance. Our working model is that the Rac-JNK pathway forms a common pathway downstream of the Cas/Crk/BCAR3 signaling complex to mediate antiestrogen resistance. Testing this model relies on reciprocal analysis of dominant-negative and constitutively active forms of the various signaling molecules in this pathway. As such, bulk of our efforts during the first year have focused on generating the genetic and cellular tools described in the report in detail, allowing us to perform rigorous functional studies on the antiestrogen resistance in breast cancer cells during the upcoming year.

DTIC

Breast; Cancer; Clinical Medicine; Estrogens; Genetics; Mammary Glands

20050200952 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA

Mechanisms of Chemoresistance in Breast Cancer Cells

Gouaze, Valerie; May 2005; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0491

Report No.(s): AD-A435635; No Copyright; Avail: CASI; [A03](#), Hardcopy

Our previous studies showed that both glucosylceramide synthase (GCS) and P- glycoprotein (P-gp) are overexpressed in Adriamycin-resistant human breast cancer cells, MCF-7-AdrR cells. When these cells were transfected with GCS antisense (asGCS), a stable 30% decrease in GCS activity was obtained. Experiments with paclitaxel (Taxol) showed that intracellular levels of drug were 8.6-fold greater in the asGCS- transfected cell line, MCF-7-AdrR/asGCS, compared to MCF-7-AdrR cells. In assessing p-gp, we observed a dramatic decrease in the level of MDR1 expression (80%) by RT-PCR that translated into a similar decrease in P-gp protein levels. To confirm the influence of GCS on MDR1 expression, we inhibited GCS. Treatment of MCF-7-AdrR cells with GCS inhibitor, 1-Phenyl-2-palmitoylamino-3-morpholino-1- propanol (PPMP), or with GCS siRNA, produced a significant decrease in MDR1 mRNA levels compared to untreated. These results were used in manuscript for publication, which showed that P-gp expression can be downregulated by either GCS antisense transfection or chemical inhibition of GCS. In order to determine whether overexpression of GCS is a general characteristic of chemotherapy resistance, we assessed GCS expression and glycolipid levels in Adriamycin-, cisplatin-, etoposide-, and paclitaxel-resistant breast cancer cells.

DTIC

Breast; Cancer; Chemotherapy; Mammary Glands; Proteins

20050200954 New York Hospital-Cornell Medical Center, New York, NY USA

The Role of Lecithin: Retinol Acyltransferase (LRAT) Mediated Esterification of Vitamin A in Regulating Human Breast Cancer Cell Proliferation and Differentiation

Su, Dan; Apr. 2005; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0440

Report No.(s): AD-A435637; No Copyright; Avail: CASI; [A02](#), Hardcopy

In this project, we stained for LRAT in normal vs malignant human breast tissues. Also, transgenic mice were generated in which human LRAT was ectopically expressed either in the suprabasal layer or in the basal layer of epithelial cells driven by the cytokeratin 10 promoter or the cytokeratin 14 promoter, respectively. The effects of ectopic LRAT expression on epithelial cell proliferation and differentiation were examined in these transgenic mice. We showed that with a normal level of retinol in the diet, the overexpression of human LRAT in the suprabasal layer or basal layer of the mouse epithelial cells affects mouse epithelial cell differentiation minimally. However, the epidermal hyperplasia induced by topical retinol treatment was greatly reduced in the human LRAT-expressing animals. These data suggest a role for LRAT in the maintenance of normal epithelial cells differentiation. Currently, studies are underway to assess the functions of LRAT in breast carcinoma prevention.

DTIC

Breast; Cancer; Cells (Biology); Mammary Glands; Regeneration (Physiology); Retinene

20050200955 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

The Detection of Protective Antigen (PA) Associated with Spores of Bacillus Anthracis and the Effects of Anti-PA Antibodies on Spore Germination and Macrophage Interactions

Cote, C. K.; Rossi, C. A.; Kang, A. S.; Morrow, P. R.; Lee, J.S.; Welkos, S. L.; Apr. 2005; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435638; RPP-04-393; No Copyright; Avail: Defense Technical Information Center (DTIC)

The protective antigen (PA) component of the anthrax toxins is an essential virulence factor of Bacillus anthracis and is the major protective immunogen. The kinetics of PA production during growth of B. anthracis, and the roles of anti-PA antibody in host immunity are not clearly defined. Production of PA by the vegetative organisms peaks during the shift from exponential to stationary phase of growth. Recently, PA was also found to be associated with spores. In our study, PA-specific mRNA was detected in spores by RT-PCR within 15-min of exposure to germinant. PA protein was detected by immunomagnetic electrochemiluminescence (ECL) on spores within 1 h of exposure to a germination medium and was rapidly released into the supernatant. PA was not demonstrated on ungerminated spores by RNA analysis, ECL, or spore-based anti-PA ELISA; however, it was detected on ungerminated spores by immunoelectron microscopy (immunoem). In rabbits, PA induces polyclonal antibodies (Abs) that, in addition to their anti-toxin neutralizing activities, exhibit anti-spore activities. In this study, the anti-spore effects of a human monoclonal Ab specific for PA (AVP-hPA mAb, Avanir Pharmaceuticals) were characterized. AVP-hPA mAb retarded germination in vitro, and enhanced the phagocytic and sporicidal activities of macrophages. The

activities were comparable to those of the polyclonal rabbit anti-rPA Ab. Assays to detect germination inhibitory activity (GIA) in serum from vaccinated mice and guinea pigs suggested a possible role for anti-PA Abs in protection. Thus, anti-PA Ab-mediated, anti-spore activities may play a role in protection during the early stages of an anthrax infection.

DTIC

Antibodies; Antigens; Bacillus; Germination; Macrophages; Spores

20050200957 Connecticut Univ., Storrs, CT USA

Relationship of Neurocognitive Function to Breast Cancer Treatment and Induced Menopause

Kenefick, Amy L.; May 2005; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0528

Report No.(s): AD-A435640; No Copyright; Avail: CASI; [A02](#), Hardcopy

This award builds on the grantee's extensive clinical background in women's health and primary care by facilitating the transition from geriatric research to breast cancer research. The grant has a training component which includes formal and informal experiences related to NCF, cancer research and research methodology, and a research component which includes the design and execution of a nine-month longitudinal, repeated measures, descriptive study of NCF in a group of women receiving chemotherapy for breast cancer. To clarify the role of induced menopause in NCF, the subjects will be compared to a group experiencing surgically induced menopause. Research project activities have been prioritized. The study has been designed, a clinical site has been chosen and negotiations with that site have been successfully concluded. A research assistant has been hired and begun training. The very slow human subjects review process has delayed beginning subject recruitment and data collection. Formal coursework will take place in year two. Training activities have included attending conferences and interdisciplinary meetings, presenting research, writing papers based on research done with the mentor and reading materials related to the design and management of longitudinal research and clinical trials, particularly in cancer.

DTIC

Breast; Cancer; Clinical Medicine; Cognition; Hormones; Mammary Glands; Medical Science

20050200958 University of Southern California, Los Angeles, CA USA

Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer

Crowe, David L.; May 2005; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0568

Report No.(s): AD-A435641; No Copyright; Avail: CASI; [A03](#), Hardcopy

BRCA1 is involved in repair of double strand breaks induced by ionizing radiation and chemotherapy drugs. BRCA1 and nuclear hormone receptors interact with p300 and CREB binding protein (CBP) to activate target gene transcription. Few studies have suggested a role for nuclear hormone receptors in DNA repair. E2 and RA had opposing effects on DNA damage and breast cancer cell survival following double strand break damage. Estradiol but not retinoic acid treatment resulted in complex formation between ERalpha, CBP, and BRCA1 in ER positive breast cancer cell lines. Mutant BRCA1 reduced DNA damage repair protein expression in human breast cancer cell lines. Mutant BRCA1 expression correlated with increased DNA damage and decreased repair activity in breast cancer cell lines but did not block nuclear hormone dependent effects. The truncated BRCA1 failed to form complexes with ERalpha and CBP which correlated with its ability to exert E2 independent effects on DNA repair. Mutant BRCA1 produced increased survival in breast cancer cells with DNA double strand breaks and inhibited cell cycle progression. Ectopic ERalpha expression was sufficient to produce the E2 mediated effects on DNA damage, repair, and survival.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Drugs; Estrogens; Mammary Glands

20050200960 Texas Univ., Dallas, TX USA

Broad Spectrum Chemotherapy: A Novel Approach Using Beta-Galactosidase Activated Pro-Drugs

Ma, Zenyi; Mar. 2005; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0331

Report No.(s): AD-A435644; No Copyright; Avail: CASI; [A03](#), Hardcopy

Prostate cancer is one of the most common malignant tumors with increasing incidence rates in the aging male, presenting a formidable public health problem. Gene therapy has been successfully exploited in several clinical trials. beta-galactosidase(beta-gal) as a reporter gene, has historically been the most popular gene for molecular biology work. A series expression lacZ gene vector was developed and two kinds of prostate cancer cells were screened by histology (X-Galstaining)

and beta-gal activity assay method to find highly expressing clones for the lacZ gene. Western blotting confirmed results. It will introduce a novel concept for further exploration for gene therapy using 1beta-galactosidase to activate a broad-spectrum chemotherapeutic to assess the efficacy of the prodrugs in vitro and explore growth delay in animal models.

DTIC

Cancer; Drugs; Neoplasms; Prostate Gland; Range (Extremes); Spectra

20050200961 Mount Sinai School of Medicine, New York, NY USA

ATM Heterozygosity and the Development of Radiation-Induced Erectile Dysfunction and Urinary Morbidity Following Radiotherapy for Prostate Cancer

Cesaretti, Jamie A.; Feb. 2005; 31 pp.; In English

Contract(s)/Grant(s): W81XWH-04-0172

Report No.(s): AD-A435645; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this training grant project is to determine whether the prevalence of ATM carriers among prostate cancer patients treated with radiotherapy that develop erectile dysfunction and urinary morbidity is greater than the prevalence of ATM heterozygosity among patients that do not develop this complication. Regardless of the scientific outcome of the proposal the PI will be left with a vast experience in translational research from which to form new hypotheses and research strategies as he begins his career as an independent physician scientist. To assure a well-rounded experience, the school of medicine will insure that the PI will participate for the first two years of the funded period in Mount Sinai's rigorous clinical research training program. The NIH sponsored program will give the PI formal instruction in Clinical Research and Policy Evaluation, Epidemiology and Biostatistics, Basic Science for the Clinical Investigator, Cultural, Illness, and Community Health Outcomes, Behavioral Medicine, and Ethical Issues in Clinical Research. Also the PI, while at Mount Sinai, will make significant progress in establishing collaborative relationships with well-established prostate cancer researchers and will continue this approach in order to expand the scope of the outlined proposal throughout the funding period of this grant.

DTIC

Cancer; Prostate Gland; Radiation Therapy; Urology

20050200967 Cincinnati Univ., OH USA

Plastic-Based Structurally Programmable Microfluidic Biochips for Clinical Diagnostics

Ahn, Chong H.; Nevin, Joseph H.; Beaucage, Gregory; May 2005; 102 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-OO-1-0569; Proj-E117

Report No.(s): AD-A435658; AFRL-IF-RS-TR-2005-202; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this project is to develop a smart disposable polymer lab-on-a-chip for clinical diagnostics and point-of-care testing, which has the sampling/identifying capability of fast and reliable measurements of metabolic parameters from a human body with minimum invasion. The fully integrated disposable biochip is capable of precise volume control with smart microfluidic manipulation without costly on-chip microfluidic components. The biochip has a unique power source using on-chip pressurized air reservoirs, for microfluidic manipulation, avoiding the need for complex microfluidic pumps. Through the project, an innovative, fully integrated, plastic microfluidic lab-on-a-chip has been successfully developed and characterized for the dual applications of a stand-alone smart disposable polymer lab-on-a-chip as well as a wrist watch-type blood analyzer.

DTIC

Clinical Medicine; Diagnosis; Microfluidic Devices

20050200968 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Cost and Performance Report for Natural Pressure-Driven Passive Bioventing

Larson, Sherrie; Hoeppel, Ron; Oct. 2004; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435659; NFESC-TR-2253-ENV; No Copyright; Avail: Defense Technical Information Center (DTIC)

This document provides information needed for comparing passive bioventing to conventional bioventing on the basis of performance, installation and operating costs, and implementation issues. The primary demonstration objective was to identify a site where passive bioventing would be successful. The secondary objective was to measure the rate of airflow and radius of oxygen influence as the result of operating a pilot-scale passive bioventing system that consisted of one vent well with a one-way passive valve and soil-gas monitoring points.

DTIC

Biodegradation; Costs; Venting; Waste Treatment

20050200971 Arizona Univ., Tucson, AZ USA

Tumor-Mediated Suppression of Dendritic Cell Vaccines

Akporiaye, Emmanuel; Mar. 2005; 37 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0126

Report No.(s): AD-A435662; No Copyright; Avail: CASI; [A03](#), Hardcopy

The unique ability of dendritic cells to potently stimulate lymphocytes in an antigen-specific fashion has made them prime candidates for cancer immunotherapy. A number of tumor-derived products have been suggested to promote tumor establishment and progression by interfering with DC functions. One of the best characterized of these factors is Transforming growth factor-beta (TGF-beta), a multifunctional cytokine that exerts potent suppressive effects on cells of the immune system. TGF-beta specifically interferes with DC maturation, chemotaxis, antigen recognition and T cell activation. These findings strongly suggest that a strategy that protects DCs from the harmful effects of TGF-beta should enhance the effectiveness of DC-based vaccines. In this study we show that TGF-beta suppression of DC vaccines can be mitigated by inhibiting TCF-B gene expression in tumor cells and by neutralization of secreted TGF-beta with specific antibody. We demonstrate that a novel small molecule TGF-beta type 1 receptor kinase inhibitor abrogates tumor-derived TGF-beta-mediated signaling and epithelial-mesenchymal transition characteristic of a more invasive phenotype. The inhibitor enhanced the effectiveness of DC vaccines in controlling the growth of established 4T1 tumors. Taken together, our studies demonstrate the usefulness of eliminating immunosuppressive tumor-derived products in order to improve the effectiveness of dendritic cell-based anti-cancer vaccines.

DTIC

Crystal Structure; Dendritic Crystals; Neoplasms; Tumors; Vaccines

20050200986 Pennsylvania Univ., Philadelphia, PA USA

Notch Signaling and Schwann Cell Transformation: Development of a Model System and Application to Human MPNSTs

Kadesch, Tom R.; Mar. 2005; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0209

Report No.(s): AD-A435693; No Copyright; Avail: CASI; [A02](#), Hardcopy

This is an annual report that presents data obtained during the grant's initial year of funding. The grant addresses the potential role of Notch signaling in the malignant transformation of neurofibromas to MPNSTs in patients with NF1. Our previous work has shown that constitutive expression of Notch can transform rat Schwann cells and that at least on MPNST-derived human Schwann cell line (of three examined) signals via Notch. This report includes novel results pertaining to two Tasks of the Statement of Work, including our observations that 1) Notch transformation of rat Schwann cells is accompanied by a loss of contact inhibition, 2) Notch signaling transiently down-regulates CyclinD1 expression in rat Schwann cells although full transformation is associated with abundant levels of CyclinD1, and 3) human MPNST cell lines down-regulate CyclinD1 in response to Notch, suggesting that these cells are not as fully transformed as NICDtransduced rat Schwann cells. The significance of these data is discussed in the context of additional Tasks described by the Statement of Work.

DTIC

Models; Notches

20050200989 Brigham and Women's Hospital, Boston, MA USA

A Novel Biochemical Pathway of ErbB2 Down-Regulation

Band, Hamid; Jul. 2004; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0303

Report No.(s): AD-A435699; No Copyright; Avail: Defense Technical Information Center (DTIC)

This proposal will examine a novel hypothesis that the HSP90/HSP70-associated co-chaperone CHIP functions as a selective ErbB2-directed ubiquitin ligase. This hypothesis is based on studies that while Cbl ubiquitin ligase negatively regulates ErbB1 (EGF receptor) by promoting its lysosomal traffic, lack of Cbl recruitment to ErbB2 upon heregulin stimulation promotes receptor recycling; however, ErbB2 can be targeted for ubiquitination via heterodimerization with ErbB1 or treatment with a therapeutic anti-ErbB2 antibody, highlighting the potential of ubiquitin ligase-mediated down-regulation of ErbB2 as a therapeutic strategy. We propose comprehensive strategies to test if CHIP functions as an ErbB2-selective ubiquitin ligase independent of Cbl, whether Cbl and CHIP can synergize to induce the ubiquitination and subsequent down-regulation of ErbB2 and reduction of cancer cell proliferation, and examine the mechanism of CHIP-mediated down-regulation of ErbB2. Validation of our hypothesis will be a major advance in ErbB receptor biology, and will provide

a rationale to synergize anti-ErbB2 antibody therapy (e.g., with ansamycins or related drugs) of ErbB2-overexpressing breast cancer patients to increase the proportion of responders and to reduce toxicity.

DTIC

Biochemistry; Breast; Cancer; Mammary Glands; Toxicity

20050200990 Minnesota Univ., Minneapolis, MN USA

Role of Angiogenesis in the Etiology and Prevention of Ovarian Cancer

Ramakrishnan, Sundaram; Oct. 2004; 383 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9564

Report No.(s): AD-A435700; No Copyright; Avail: Defense Technical Information Center (DTIC)

Ovarian cancer growth and its dissemination into the peritoneal cavity are dependent on angiogenesis. Therefore, angiogenesis inhibitors can be used in the prevention and treatment of ovarian cancers. One of the objectives of Project 1 is the development of a genetically reengineered angiostatic protein, endostatin. A mutant endostatin containing a single amino acid substitution at position 125 (P125A-endostatin) was found to be more active than the native protein. P125A endostatin was further modified to incorporate vascular targeting sequence, RGD, so that the bioavailability can be increased at the tumor vasculature. Modified endostatins were evaluated for antiangiogenic and antitumor activities in model systems. Genetic modifications significantly improved the biological activity of endostatin. Synthetic peptides corresponding to the mutation site were made to characterize the mechanism of enhanced antiangiogenic activity. Since a slow release formulation was more effective than the bolus injections, a gene therapy approach was developed to deliver the mutant endostatin to inhibit ovarian cancer growth.

DTIC

Angiogenesis; Cancer; Etiology; Health; Ovaries; Prevention

20050200996 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Cost and Performance Report for Bioavailable Ferric Iron (BAFeIII) Assay

Lebron, Carmen; Evans, Patrick; Trute, Mary; Olsen, Roger; Chappell, Rick; Wilson, John; Adair, Cheri; Weber, Eric; Kenneke, John; Thomas, B. T.; Jun. 2005; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435716; CR-05-005-ENV; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report describes the demonstration and validation of a novel analytical technology: a bioavailable ferric iron (BAFeIII) assay. Demonstration and validation of the BAFeIII assay was conducted at four Department of Defense (DoD) installations.

DTIC

Assaying; Bioassay; Costs; Iron; Sediments; Soils

20050201001 Native American Industrial Distributors, Inc., Upper Marlboro, MD USA

U.S. /Poland Cooperative Telemedicine Program

Marcinik, Edward J.; Apr. 2005; 22 pp.; In English

Contract(s)/Grant(s): W81XWH-04-2-0019

Report No.(s): AD-A435724; No Copyright; Avail: CASI; [A03](#), Hardcopy

Hardware requirements for the Polish military telemedicine system are enormous. Modern ruggedized versions of commercial equipment need to be installed. The system should be linked to the transmission network with large archiving capability. Translation into Polish should be relatively straightforward but all the changes and modifications may be difficult and time-consuming if the source code is in the USA. Licensing the source code to one of the Polish companies (Consortia) is a potential solution. The main limitations of military telemedicine are the existing network infrastructure and quality of equipment. Planned network solutions should meet suitable link parameters (bandwidth, delay, 005 etc)

DTIC

Computers; Networks; Poland; Telemedicine

20050201004 Stanford Univ., Stanford, CA USA

Oral Contraceptives and Bone Health in Female Runners

Kelsey, Jennifer L.; Oct. 2004; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8518

Report No.(s): AD-A435728; No Copyright; Avail: CASI; [A02](#), Hardcopy

This is a two-year randomized trial of the effects of oral contraceptives on bone mass and stress fractures incidence among 151 female competitive distance runners in the age range 18-25 years. The Coordinating Center is at Stanford University and bone mass is being measured at five sites: Massachusetts General Hospital, University of California Los Angeles, University of Michigan, Stanford University/Palo Alto VA Medical Center, and Helen Hayes Hospital in West Haverstraw, NY. Athletes were recruited mostly from the areas around these five clinical sites. Over the five clinical sites, 151 runners were randomized, and follow-up continues. Follow-up will be completed in October 2005, and final results of the study should be available in early 2006.

DTIC

Athletes; Bones; Females; Health

20050201022 John P. Roberts Research Inst., London, Ontario Canada

New Transfer Theory Relationships for Signal and Noise Analyses of X-Ray Detectors

Cunningham, Ian A.; Oct. 2005; 145 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9226

Report No.(s): AD-A435763; No Copyright; Avail: CASI; [A07](#), Hardcopy

X-ray mammography is the most reliable method available at present for the detection of breast cancer in screening programs. Unfortunately, it still misses many cancers, particularly in the radiographically dense breast more common in younger populations where the benefits of mammography screening are more controversial. Digital mammography holds the promise of improved specificity and sensitivity for the detection of small cancers. However, superior image quality can only be achieved if these digital systems are optimally designed to extract all information possible from the x-ray beam. The metric most generally accepted to describe signal and noise performance of detectors is the detective quantum efficiency (DQE), and theoretical methods for predicting the DQE are essential for the optimal design of new systems. Current methods using 'cascaded-systems' analyses are simplistic and do not agree very well with measurements. In this research, we introduced the idea of 'parallel cascades' as a means of developing comprehensive models of x-ray detectors that accurately describe the DQE of many x-ray systems. We discovered a mathematical description of the required cross-spectral noise-power density and showed that this approach gives an accurate estimate of the DQE based on design parameters. The results of this research are now used routines in the design and assessment of new x-ray systems by scientists and engineers in both academic and industrial laboratories around the world.

DTIC

Breast; Cancer; Detectors; Mammary Glands; Optimization; Signal to Noise Ratios; X Ray Detectors; X Rays

20050201025 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Advances in Biomagnetic Interfacing Concepts Derived from Polymer-Magnetic Particle Complexes

Riffle, Judy S.; Jun. 2005; 7 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0352

Report No.(s): AD-A435766; AFRL-SR-AR-TR-05-0274; No Copyright; Avail: CASI; [A02](#), Hardcopy

Our research on the development and characterization of magnetic nanoparticle-polymer complexes for tile project period 6/1/03-12/31/04 has yielded approximately 10-nm diameter cobalt particles coated with graphitic or silica protective shells to prevent oxidation of the particle surfaces. The specific saturation magnetizations of the protected particles range from 50-112 emu/g, which is up to about five times the response of our previous nanoparticle materials. Oxidative durability results demonstrate that both classes of systems yield oxidatively-stable cobalt nanoparticles in air or water. However, the graphitic coatings are significantly more mechanically robust relative to the silica coatings. By contrast, the silica coatings can be readily functionalized with desirable functional groups. Collaborations with Prof. St. Pierre's biophysics group in Australia have been valuable to understand tile material and magnetic properties of these new materials. Accomplishments during this project also include a method for preparing magnetite microspheres with the biodegradable polymer, poly(L-lactide), strongly adsorbed onto the particle surfaces. The magnetite nanoparticles for this research are 4.8 nm in radius (by dynamic light scattering), and are superparamagnetic. Efforts with the magnetite-polymer complexes have been coordinated with Drs. Rosengart (U. Chi.) and Kaminski/Mertz (Argonne), and will continue as we jointly learn how to tailor surfaces to avoid immune response and to complex with biospecific groups.

DTIC

Biomagnetism; Cobalt; Magnetic Properties; Magnetite; Microparticles; Pyrolysis; Silicon Dioxide

20050201026 Virginia Univ., Charlottesville, VA USA

Aromatase Overexpression and Breast Cancer Development

Yue, Wei; Wang, Jiping; Li, Yuebai; Gunselman, Sandra; Cavalieri, Ercole; Rogan, Eleanor; Fernandez, Sandra; Russo, Jose; Aug. 2004; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0444

Report No.(s): AD-A435768; No Copyright; Avail: CASI; [A02](#), Hardcopy

Estrogen can be metabolized to hydroxylated catechol estrogen, a genotoxic metabolite of estrogen, which causes DNA damage and tumors in animal models. In situ synthesis of estrogen in the breast through aromatase results in high tissue estrogen concentrations. We hypothesized that overexpression of aromatase in breast tissue increases tissue estradiol concentrations and consequent genotoxic metabolites, and eventually causes breast cancer. To test our hypothesis, we stably expressed aromatase cDNA in MCF-10A cells, a benign breast epithelial cell line. We have demonstrated that MCF-10A(arom) cells expressed functional aromatase. We demonstrated that MCF-10A(arom) cells expressed functional aromatase using tritiated water release assay and products isolation by thin layer chromatography. MCF-10A(arom) cells, incubated for 3 months with aromatase substrate, androstenedione, formed colonies in soft agar indicating the overexpression of aromatase induces cellular transformation. MCF-10A(arom) cells have all enzymes required to convert estrogen to catechoestrogens and quinone. Overexpression of aromatase enhanced production of genotoxic metabolites, which could be blocked by aromatase inhibitor, letrozole. We finished the long-term in vivo study. MCF-10A(arom) cells did not form tumors in nude mice.

DTIC

Breast; Cancer; Catecholamine; Hydroxyl Radicals; Mammary Glands; Metabolites

20050201028 Brandeis Univ., Waltham, MA USA

Model-Driven Study of Visual Memory

Sekuler, Robert; Dec. 2004; 65 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0376

Report No.(s): AD-A435772; AFRL-SR-AR-TR-05-0276; No Copyright; Avail: CASI; [A04](#), Hardcopy

Short-term episodic visual recognition memory is crucial to success in many everyday activities. We synthesized concepts, insights, and methods from memory research, and from vision research, working within a coherent, quantitative framework for understanding episodic visual recognition memory. Seven experiments were carried out in two related sub-projects. One sub-project confirmed that high-dimensional stimuli (synthetic human faces) afford important insights into episodic recognition memory. The results were well accommodated by a summed similarity theory of recognition memory (Kahana & Sekuler, 2002). The second sub-project supported coordinated experiments on recognition memory and item identification (source memory). Source identification errors were deterministic rather than stochastic, and their causes were identified. Receiver operating characteristics (ROCs) compared recognition across experiments. Combining signal detection theory and a summed similarity model explained the unusual properties of the z-transformed ROCS.

DTIC

Computer Storage Devices; Memory; Visual Perception

20050201029 Massachusetts General Hospital, Boston, MA USA

Medical Simulation 2004: Emerging Science/Enabling Technologies

Dawson, Steven L.; Cotin, Stephane; Jun. 2004; 5 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0467

Report No.(s): AD-A435773; No Copyright; Avail: CASI; [A01](#), Hardcopy

The International Symposium on Medical Simulation (ISMS'04) was held in Cambridge, Massachusetts, USA on June 17th and June 18th, 2004. The objective of the symposium was to bring together the researchers in this field to present their most up-to-date, innovative and promising work, to highlight research trends and foster dialogue and debates among participants. To address questions about the areas for improvement and the future directions of the field, we organized a panel of experts including technical, medical and educational representatives. This event was a continuation of successful symposium organized by Herve Delingette and Nicholas Ayache, in France in June 2003. This year's symposium was co-organized by CIMIT / Harvard Medical School and Rutgers University. We received 50 papers from 14 countries. We selected 16 papers for oral presentation and 16 papers for poster presentation. All accepted articles were allowed a written contribution of equal length in the proceedings. The contributions published in the proceedings are from research institutes, universities or companies from our diverse research community, including: Germany, Russia, Netherlands, France,

Switzerland, Belgium, Spain, UK, Italy, Japan, Korea, Israel, Canada and the USA of America.
DTIC
Medical Science; Simulation

20050201035 Michigan Univ., Ann Arbor, MI USA

A Numerical Investigation of Metabolic Reductive Dechlorination in DNAPL source Zones

Christ, John A.; Jan. 2005; 310 pp.; In English

Report No.(s): AD-A435780; CI04-1134; No Copyright; Avail: CASI; [A14](#), Hardcopy

Among the most intractable environmental remediation problems are those involving the release of dense non-aqueous phase liquids (DNAPLs), such as chlorinated solvents, to the subsurface. Research efforts have focused on the use of numerical models to investigate reductions in contaminant concentrations due to partial mass removal and improvements in the performance of complementary source zone remediation technologies. Previous numerical investigations, however, have been limited to two-dimensional systems. Furthermore, a lack of models capable of simulating the most promising complementary technology, metabolic reductive dechlorination, has limited its application. This work developed and applied compositional multiphase numerical simulators to examine the influence of dimensionality (two-dimensions versus three-dimensions) on DNAPL source zone simulations and to investigate the benefits of stimulating metabolic reductive dechlorination at a chlorinated ethene-DNAPL contaminated site. Results from the dimensionality investigation showed that the simulation of DNAPL migration, entrapment, and dissolution in two dimensions provided reasonable approximations to the behavior simulated in three dimensions. Commonly employed saturation distribution and mass recovery metrics were approximately equivalent. Flux- averaged concentrations simulated in two dimensions, however, tended to be three to four times higher than those simulated in three dimensions. This difference was attributed to dilution at the down gradient boundary. An alternative metric, mass flux reduction, however, yielded better agreement.

DTIC

Chlorination; Liquid Phases; Metabolism; Numerical Analysis

20050201039 Kentucky Univ., Lexington, KY USA

Anxiety in Patients with Cardiac Disease

DeJong, Marla J.; Jan. 2005; 308 pp.; In English

Report No.(s): AD-A435787; CI04-1135; No Copyright; Avail: CASI; [A14](#), Hardcopy

Anxiety may cause adverse outcomes through physiologic pathways in patients with cardiac disease. The purpose of this dissertation was to investigate anxiety and its correlates in persons with acute myocardial infarction (AMI) and heart failure (HF). The specific aims were to: 1) evaluate whether anxiety levels early after AMI differ across five countries, and to determine whether an interaction between country, and sociodemographic and clinical variables contributes to variations in reporting anxiety; 2) review and analyze the measurement of anxiety for cardiac patients; 3) determine whether heart rate (HR) and blood pressure (BP) are related to anxiety in patients with HF, patients with AMI, and healthy individuals; 4) determine whether the single-item Anxiety Level Index (ALI) is a valid alternative to the State Anxiety Inventory (SAI) or the anxiety subscale of the Brief Symptom Inventory (BSI) for assessing state anxiety in patients with AMI; 5) determine the best predictive model of health status, given sociodemographic, clinical, health perception, and emotional variables for patients with HF; and 6) review neural control of HR, describe heart rate variability (HRV), and summarize research findings regarding HRV of HF patients. Four studies were conducted using existing data from four samples of patients with either AMI or HF. The first was a prospective, comparative study of 912 patients from five countries regarding anxiety after AMI. In the second study, a cross-sectional design was used to examine the relationships of anxiety with and HR and BP in 54 patients with AMI, 32 patients with HF, and 31 healthy individuals. Next, cross-sectional data on three measures of anxiety were analyzed in 243 patients with AMI. Finally, cross-sectional data from 87 patients with HF were evaluated to determine predictors of health status.

DTIC

Anxiety; Blood Pressure; Cardiovascular System; Failure; Health; Heart Diseases; Heart Rate; Myocardial Infarction; Patients

20050201041 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Dissociation of Hexavalent Chromium from Primer Paint Particles into Simulated Mucus Fluid

Moran, Michael P.; LaPuma, Peter T.; Jan. 2005; 107 pp.; In English

Report No.(s): AD-A435789; CI04-1136; No Copyright; Avail: CASI; [A06](#), Hardcopy

The military relies heavily on chromate primer paints to protect equipment from corrosion. Epidemiological studies link chromate exposure to cancer however limited studies suggest exposure to chromate paint particles does not increase the risk of lung cancer. The particle size and paint type may hinder chromate released into lung fluid. To simulate particle deposition in the mucosal layer of the lungs, a viable cascade impactor collected paint particles into porcine-based simulated lung fluid (SLF). Samples were tested after 24 hours for dissolved and total chromate to determine the fraction of Cr(exp +6)(exp +6) that dissociated from the particles into the Porcine-SLF. In strontium chromate paints, 0.65-2.1 microns sized particles released significantly less chromate than 2.1-7.0 micron sizes. Barium chromate paints only released 3-7% of its chromate, while strontium based paints released from 20-90%. This method demonstrates a technique to evaluate the bioavailability of contaminants from any type of aerosols.

DTIC

Cancer; Chromium; Dissociation; Fluids; Lungs; Membranes; Metal Particles; Mucus; Paints; Primers (Coatings)

20050201044 Oregon Health Sciences Univ., Portland, OR USA

IGF-Regulated Genes in Prostate Cancer

Roberts, Charles T., Jr; Feb. 2005; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0122

Report No.(s): AD-A435794; No Copyright; Avail: CASI; [A02](#), Hardcopy

We hypothesized that genes that are differentially expressed as a result of the decreased IGF-I receptor gene expression seen in metastatic prostate cancer contribute to prostate cancer progression, and include metastasis-regulating genes that could constitute valuable diagnostic markers or therapeutic targets. We initially proposed three specific aims: 1) Identification of differentially expressed genes in isogenic metastatic vs. non-metastatic prostate epithelial cells; 2) Identification of proteins that are differentially secreted in these cell lines, and 3) Assessment of the differential expression of these genes and proteins in laser-microdissected samples. We have used microarray gene profiling to characterize differentially expressed genes and have used SELDI-TOF mass spectrometry to identify proteins that are differentially secreted into conditioned media. In the last year, we obtained initial data suggesting that elevated IGF-I receptor expression controlled survival in adult human male serum, which may explain the relationship between IGF action and metastasis. We proposed to take advantage of these new findings by investigating the molecular mechanisms underlying this effect and the cell-surface molecules expressed in metastatic and non-metastatic cells responsible for the differential sensitivity to serum, and requested a change in the statement of work. Unfortunately, these findings were not repeatable with subsequent batches of human serum, so that we have obtained a no-cost extension through 2/06 to readdress the marginal specific aims.

DTIC

Cancer; Genes; Insulin; Prostate Gland; Proteins

20050201046 Dana Farber Cancer Inst., Boston, MA USA

Promoter and Cofactor Requirements for SERM-ER Activity

Carroll, Jason; May 2005; 15 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0512

Report No.(s): AD-A435797; No Copyright; Avail: CASI; [A03](#), Hardcopy

The mechanisms of estrogen-mediated transcription are not completely understood and as such, the roles of Selective Estrogen Receptor Modulators (SERMs), such as tamoxifen are also poorly understood. Our current work is focused on assessing the relative contributions of the specific promoter sequences within estrogen target genes and how they influence the transcriptional activity by different ligands. Specifically, we have generated breast (MCF-7) and endometrial (ECC1) cancer cell lines with a Lox-Luciferase cassette integrated within the chromatin. These clonal cell lines have been screened by Southern blot and FISH to confirm the presence of a single integration site. Different promoter sequences from estrogen regulated genes have been introduced into these donor cell lines via Cre-mediated recombination. To insert these specific promoter sequences into the same site within the chromatin, we generated an insertion vector containing a multiple cloning sites flanked by Lox sites. After integration of the various promoter sequences we used negative selection to generate cell lines that contained the different promoter sequences within the same chromatin setting. These cell lines are currently being assessed for luciferase activity in the presence of different ligands.

DTIC

Estrogens; Modulators

20050201047 California Univ., Los Angeles, CA USA

Imaging Metastatic Prostate Cancer After Genetic Manipulation of Transcriptional Memory Regulators EZH2 and EED

Wu, Lily; Jan. 2005; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0138

Report No.(s): AD-A435799; No Copyright; Avail: CASI; [A02](#), Hardcopy

This project is intended to explore the role of polycomb group protein EZH2 and its binding partner EED in metastatic prostate cancer. Both proteins will be introduced and overexpressed independently overexpressed in prostate cancer xenograft models by lentiviral transduction. Concordantly, the effects of reduced EZH2 or EED expression will be evaluated by RNAi technology. The growth and progression of the tumors will be monitored by optical imaging. The hypothesis is that EZH2 serves as a master regulator protein in prostate cancer metastasis; therefore, disruption of the balance between EZH2 and EED will result in a more aggressive disease phenotype. Exploration of the relationship between EZH2 levels and kinetics of dissemination of cancer cells will result in a better understanding of disease progression and appropriate treatment approaches.

DTIC

Cancer; Genetics; Imaging Techniques; Initiators (Explosives); Metastasis; Prostate Gland; Regulators

20050201048 Duke Univ., Durham, NC USA

Inhibition of Telomerase as a Therapeutic Target for the Treatment of Prostate Cancer

Counter, Christopher M.; Feb. 2005; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0049

Report No.(s): AD-A435800; No Copyright; Avail: CASI; [A02](#), Hardcopy

Malignant prostate cells must divide many times to form a tumor, metastasize or recur after therapy. Critical for this type of endless cell division is an enzyme named telomerase. This enzyme is usually dormant in most normal tissues, but is resurrected in prostate cancer cells by yet unknown genetic changes. Since the enzyme is required for survival of cancer cells but is not present in most normal cells, inhibition of telomerase may specifically target prostate cancer cells. We have shown that impeding the function of telomerase by expressing a mutated version of this protein kills prostate cancer cells in an experimental setting. We now wish to translate this finding into a more practical application by searching for smaller molecules capable of inhibiting telomerase activity. The approach we propose to take is one that capitalizes on reagents already in hand. First, we have mapped parts of telomerase that are extremely sensitive to even small disruptions. We now wish to find molecules that bind to these sensitive regions, as such regions represent the most attractive parts of the protein to target for inhibition. We will therefore screen millions upon millions of small molecules, termed peptides, for those few that adhere to these regions of the telomerase enzyme. Such peptides could serve as a blueprint to develop even more clinically relevant inhibitors of telomerase.

DTIC

Cancer; Prostate Gland; Targets; Therapy

20050201050 Baylor Coll. of Medicine, Houston, TX USA

The Role of the Neurofibromin-Syndecan-Cask Complex in the Regulation of Synaptic Ras-MAPK Signaling and Dendritic Spine Plasticity

Wu, Gang-Yi; Feb. 2005; 11 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0260

Report No.(s): AD-A435803; No Copyright; Avail: CASI; [A03](#), Hardcopy

Neurofibromatosis type 1 (NF1) is a common dominant genetic disorder characterized by multiple benign and malignant tumors of neural origin and, often, cognitive deficits in children. The protein encoded by NF1, neurofibromin, contains a GAP domain, known to inhibit Ras-mediated signal transduction, a pathway known to be required for memory formation. This proposal will define the newly identified NP1-Syndecan2-CASK signaling complex in the regulation of synaptic Ras-MAPK activity and dendritic spine maturation. The specific Aims are: 1) To determine whether the NP1-syndecan-CASK signaling complex is an essential negative regulator for synaptic Ras-MAP kinase activity during synaptic maturation. 2) To define the role of the NP1-syndecan-CASK signaling complex in the formation and maturation of dendritic spines. 3) To assess if NF1-deficient cells have an altered capacity to undergo morphological plasticity after spaced depolarizing stimuli, and whether the deficits in morphology can be rescued by manipulating Ras-MAPK signaling. We have made excellent progress on developing several siRNAs and dominant negative constructs for NF1 GAP activity to specifically knockdown or inhibit NF1, and have begun to assess their effects on Ras-MAPK signaling and spine maturation. Furthermore, we have obtained

compelling evidence showing that Nf1+/- neurons display hyperactive basal and evoked MAPK activity.
DTIC

Barrels (Containers); Cells (Biology); Children; Genetics; Nervous System; Plastic Properties; Spine

20050201051 New Mexico Univ., Albuquerque, NM USA

The Role of Telomeric Repeat Binding Factor 1 (TRF1) in Telomere Maintenance and as a Potential Prognostic Indicator in Human Breast Cancer

Butler, Kimberly S.; Griffith, Jeffrey K.; Apr. 2005; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0370

Report No.(s): AD-A435804; No Copyright; Avail: CASI; [A03](#), Hardcopy

The aims of this study are to (i) determine the relationships between the telomere binding protein Telomere Repeat Binding Factor 1 (TRF1) and other telomere binding proteins, (ii) establish the potential of TRF1 as a surrogate marker for telomere content (TC) and as a potential clinical marker and (iii) characterize the relationship between of the telomere binding protein TRF1 and TC. Through examining the role of TRF1 in telomere length control and in breast cancer progression, this project also fosters the education of the candidate through the interaction with several experts in breast cancer pathology, biostatistics, and clinical and basic research. The experiments involved require the interaction with professionals from several different fields of the biomedical sciences and the mastery of several challenging laboratory techniques. To date, all tasks, as outlined in the Statement of Work, are on schedule. The research is in progress.

DTIC

Breast; Cancer; Maintenance; Mammary Glands; Proteins; Telomeres

20050201059 Cornell Univ., Ithaca, NY USA

Investigating the Role of FIP200 in Mammary Carcinogenesis Using a Transgenic Mouse Model

Nagy, Tamas; Apr. 2005; 9 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0400

Report No.(s): AD-A435823; No Copyright; Avail: CASI; [A02](#), Hardcopy

TRE2-HA-FIP200-IRES2-EGFP-h beta g3' DNA fragment was used to create transgenic mice by pronuclear injection into fertilized FVB/N eggs. Three independent TRE2-FIP200 founders were identified with PCR screening with EGFP primers. All three founders and their transgenic offspring are clinically normal, fertile, their litters are of normal size, their pups exhibit normal growth-rate. Mammary gland morphology is normal in all physiological stages in the TRE2-FIP200 mice when compared to wild-type littermates. Double transgenic offspring were created by mating TRE2-FIP200 transgenic mice to the regulator (MMTV-rtTA) mice. The double transgenic mice are clinically normal, fertile, their litters are of normal size, their pups exhibit normal growth-rate. After doxycycline supplementation of the drinking water the transgenic FIP200 message can be detected with RT-PCR in one line (c3) of double transgenic animals. So far, attempts to detect transgenic FIP200 protein with immunoblotting, immunoprecipitation, and immunohistochemistry were unsuccessful. Experiments are planned to solve this problem. Experiments are being conducted to monitor mammary gland development in the double transgenic animals during pregnancy with or without doxycycline treatment.

DTIC

Carcinogens; Mammary Glands; Mice

20050201067 Vanderbilt Univ., Nashville, TN USA

Molecular Markers of Estrogen Metabolism and Progression from High-Grade Prostatic Intraepithelial Neoplasia (HGPIN) to Prostate Cancer

Fowke, Jay H.; Feb. 2005; 14 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0139

Report No.(s): AD-A435842; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose of this case-control study is to investigate the association between genetic and endocrine markers of estrogen metabolism and prostate cancer progression. Androgens (e.g., testosterone) may be critical in prostate carcinogenesis, but there is accumulating evidence that estrogens facilitate progress during the later stages of prostate cancer formation. To explore the role of estrogens in human prostate carcinogenesis, we proposed to investigate the association between genetic and endocrine markers of estrogen metabolism and the detection of high-grade prostatic intraepithelial neoplasia (HGPIN) and stage I/II/III prostate cancer. The first project year included protocol development and IRB approval, and the second year focused on subject recruitment and data collection. The third year focused on recruitment, data collection, and analysis. Specific

accomplishments include recruitment of 489 subjects to the protocol (90% of eligibles). We have conducted several analyses looking at the association between genetic variants and prostate cancer. We have exceeded recruitment goals, and at this time have met almost all data collection and processing goals. Further details provided below are in parallel with the statement of work.

DTIC

Cancer; Estrogens; Markers; Metabolism; Prostate Gland

20050201070 California Univ., Irvine, CA USA

A Functional Genomic Analysis of NF1-Associated Learning Disabilities

Tang, Shao-Jun; Feb. 2005; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0261

Report No.(s): AD-A435850; No Copyright; Avail: CASI; [A02](#), Hardcopy

Learning disabilities severely deteriorate the life of many NF1 children by limiting their academic achievement, higher education and career choice. However, the pathogenic process for NF1-associated learning disabilities has not been fully understood and an effective +/- therapy is not available. This study was proposed to identify genes that are dysregulated in the hippocampus of the NF1 mouse model by DNA microarray analysis. Characterization of these NF1-affected genes will dramatically improve our understanding of the molecular pathogenesis underlying NF1-associated learning deficits. During the first year of the project, we have (i) established an NF1 mouse colony to generate NF1 mice used in this study, (ii) purified RNAs from the NF1+/- and wild-type hippocampus and (iii) performed LTP experiments on NF1+/- and wild-type hippocampal slices to prepare slices after LTP induction for RNA purifications. These progresses lay down a firm foundation for us to complete the proposed microarray experiments in the next two years.

DTIC

Children; Deoxyribonucleic Acid; Disabilities; Functional Analysis; Genes; Genome; Hippocampus

20050201072 Vanderbilt Univ., Nashville, TN USA

Paracrine Regulation of Prostatic Carcinogenesis

Hayward, Simon W.; Jan. 2005; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0151

Report No.(s): AD-A435853; No Copyright; Avail: CASI; [A03](#), Hardcopy

This report summarizes the work performed during this study. The long term goal of this project is to better understand why some prostate tumors grow aggressively while others are extremely slow growing lesions. The objective of the proposed research is to establish immortalized stromal cell lines derived from normal human prostate and from human prostate cancer and to use these cells to investigate the role of IGFs in prostate cancer growth. A number of new molecular tools were generated in the course of this project. A new technology (RNA interference) came into common use allowing us to suppress gene expression in a manner of technical complexity to overexpression of genes. We have been one of the first groups to be able to use this approach in tissue recombination models. As a result we have been able to identify the effects of suppression of IGF signaling in human prostate cancer cells in vivo as a mechanism to inhibit invasion and enhance differentiation.

DTIC

Cancer; Carcinogens; Lesions; Prostate Gland

20050201073 Yale Univ., New Haven, CT USA

The Role of Ubiquitin E3 Ligase SCFSKP2 in Prostate Cancer Development

Zhang, Hui; Feb. 2005; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0230

Report No.(s): AD-A435854; No Copyright; Avail: CASI; [A02](#), Hardcopy

The CDK inhibitor p27Kip1 acts as a negative regulator in the cell cycle and in prostate tumorigenesis. Either the loss of p27 or over-expression of its key regulator ubiquitin E3 ligase SKP2 is associated with prostate cancer. Prostate-specific expression of SKP2 is sufficient to induce hyperplasia, dysplasia, and low grade carcinoma in the mouse prostate gland. We propose to examine whether SKP2 cooperates with or is regulated by tumor suppressors such as Pten or Nkx3.1 implicated in prostatic tumorigenesis. In the past year, we have initiated the experiments by breeding and expansion of the colonies, crossing the SKP2 transgenic mice into Pten +/- strains, and ordering Nkx3.1 mice. Compound mice of SKP2 transgene and Pten +/- were made. Our initial studies suggest that there is no substantial difference in tumor frequency and grade in the SKP2 and Pten +/- compound mice versus single genetic alterations. These results suggest that PTEN may act through SKP2

for tumorigenesis. Since most of Pten null mice died early due to tumor growth in other tissues, we are in the process using Pten conditional knockout mice and prostate-specific-Cre recombinase to remove Pten in the prostate gland to determine the relationship between PTEN null and SKP2 expression.

DTIC

Cancer; Enzymes; Growth; Prostate Gland

20050201074 Alaska Univ., Fairbanks, AK USA

Molecular Mechanisms of Metabolic Suppression: Protein Synthesis and Mitochondrial Respiration in a Hibernating Ground Squirrel Model

Boyer, Bert B.; Jun. 2005; 5 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0907

Report No.(s): AD-A435855; No Copyright; Avail: CASI; [A01](#), Hardcopy

We have discovered that mitochondrial proton conductance is unchanged during hibernation and that the reduced metabolism observed in hibernators is a partial consequence of tissue specific depression of substrate oxidation. Using proton leak analyses we show that increases in uncoupling protein 3 expression do not serve a thermogenic function. Rather uncoupling protein 3 likely protects against the accumulation of fatty acids in the mitochondrial matrix. The polyA binding protein-mRNA interactions observed previously in hibernating animals are also observed in explants from squirrels not hibernating. These data suggest that PABP-mRNA interactions are a consequence of cold temperature. Using a mouse cDNA array, we have discovered several additional candidate genes that appear upregulated during hibernation. The functional significance of this result is currently being determined. We have developed black bear cDNA libraries for the ultimate construction of a bear array that will be used in future comparative studies of hibernation.

DTIC

Ground Squirrels; Hibernation; Metabolism; Mitochondria; Protein Synthesis; Respiration; Squirrels

20050201075 Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

Hepatocyte Growth Factor and Interleukin-6 in Prostate Cancer Bone Metastasis

Knudsen, Beatrice S.; Mar. 2005; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0159

Report No.(s): AD-A435856; No Copyright; Avail: CASI; [A03](#), Hardcopy

The hypothesis of this grant proposal is that androgen-ablative therapy paradoxically increases growth factor secretion from bone stromal cells and that this may stimulate the growth of prostate cancer metastases. We proposed to test this hypothesis using IL-6 and HGF/SF as paradigms of androgen regulated growth stimulators. However, two separate experimental approaches did not demonstrate an increase in IL-6 or HGF/SF gene expression in androgen-deprived mouse bone. As a result of this initial negative investigation in task 1 we decided to take a broad approach to identify genes up-regulated by androgen deprivation in mouse bone. This approach has revealed multiple genes overexpressed upon androgen-ablation that may regulate growth factor systems involved in the crosstalk between the bone environment and prostate cancer cells.

DTIC

Bones; Cancer; Hormones; Immune Systems; Interleukins; Males; Metastasis; Prostate Gland

20050201076 Stanford Univ., Stanford, CA USA

Development of a Novel Tissue slice Culture Model of Human Prostate Cancer

Peehl, Donna M.; Feb. 2005; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0144

Report No.(s): AD-A435857; No Copyright; Avail: CASI; [A03](#), Hardcopy

This project achieved all of its goals. Preparation of prostate tissue slices was optimized by a variety of technological improvements. Optimal culture conditions were identified for the maintenance of structure and function of cultured tissue slices for at least 48 hours. The requirement for androgen to maintain the secretory epithelium in cultured tissue slices was demonstrated. The effects of a number of clinically relevant compounds on gene expression, protein expression, structure and function were effectively analyzed in tissue slice cultures. We conclude that challenges still remain to achieve long-term culture of tissue slices with full preservation of structure and function, but unique preclinical information can already be gained from this methodology as it has been developed so far.

DTIC

Cancer; Culture Techniques; Prostate Gland; Tissues (Biology)

20050201078 Winston-Salem State Univ., Winston-Salem, NC USA

Selective Killing of Prostate Tumor Cells by Cytocidal Viruses

Lyles, Douglas S.; Feb. 2005; 29 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0155

Report No.(s): AD-A435859; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal was to develop novel vectors for therapy of prostate tumors based on vesicular stomatitis virus (VSV). The novelty in our approach is our ability to enhance the selectivity of VSV-induced killing of tumor cells versus normal cells by manipulating the viral genes that control the antiviral interferon response. Aim 1 was to identify mutations in VSV genes that enhance the differential killing of prostate tumor cells versus normal cells. Aim 2 was to identify VSV mutants that enhance the antiviral interferon response in prostate cells. Aim 3 was to determine whether VSV mutants have greater efficacy and safety than wild-type VSV in reducing prostate tumors in nude mice. We identified VSV mutants with enhanced ability to kill prostate tumor cells versus normal prostatic epithelial cells in culture (Aim 1). We showed that the same mutant had enhanced ability to induce antiviral interferon responses (Aim 2), and was an effective killer of interferon-nonresponsive prostate tumors established in nude mice. However, we found that other prostate tumors are responsive to interferons, and are resistant to treatment with oncolytic VSV in vivo. These data suggest that screening of prostate tumors for susceptibility may be necessary prior to treatment with oncolytic VSV.

DTIC

Cancer; Cells (Biology); Prostate Gland; Tumors; Viruses

20050201083 Purdue Univ., West Lafayette, IN USA

Regulation of Prostate Tumor Cell Line Proliferation and Tumorigenicity by ErbB4

Riese, David J.; Feb. 2005; 29 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0130

Report No.(s): AD-A435869; No Copyright; Avail: CASI; [A03](#), Hardcopy

ErbB4 is a member of the ErbB family of receptor tyrosine kinases, a family that also includes the Epidermal Growth Factor Receptor (EGFR/ErbB1), ErbB2/HER2/Neu, and ErbB3/HER3. In small pilot studies, ErbB4 expression was detected in normal prostate epithelium but was absent in prostate tumor samples. Thus, we have hypothesized that ErbB4 is a potential prostate tumor suppressor. We have tested this hypothesis using constitutively-active ErbB4 mutants. The constitutively-active Q646C ErbB4 mutant inhibits drug-resistant colony formation by human PC-3 and DU-145 prostate tumor cell lines. Analyses of additional ErbB4 mutants indicate that growth inhibition by the Q646C ErbB4 mutant appears to require phosphorylation of ErbB4 Tyr1056 as well as ErbB4 tyrosine kinase activity.

DTIC

Cancer; Cells (Biology); Enzymes; Epidermis; Epithelium; Phosphorus; Prostate Gland; Regeneration (Physiology); Tumors

20050201084 ManTech Environmental Technology, Inc., Dayton, OH USA

In Vitro Toxicity of Nanoparticles in BRL 3A Rat Liver Cell Lines

Hussain, Saber M.; Gearhart, Jeff M.; Hess, Krista L.; Schlager, John J.; May 1998; 22 pp.; In English

Contract(s)/Grant(s): F33615-00-C-6060; Proj-2312

Report No.(s): AD-A435870; AFRL-HE-WP-TR-2004-0048; No Copyright; Avail: CASI; [A03](#), Hardcopy

The development of nanoscience has created rapid advancement in electronics, sensors, munitions and propulsion technology. Recently, nanomaterials have received enormous attention for their potential applications in biology and medicine. However, the adverse biological affect of these nanoparticles originating from current nanotechnology has not been studied. Further comparison of these results with other nanomaterials and using other in vitro cells originating from pulmonary and skin tissues are being pursued.

DTIC

In Vitro Methods and Tests; Liver; Nanoparticles; Rats; Toxicity

20050201085 Rochester Univ., NY USA

Decreased Migration of Langerhans Precursor-Like Cells in Response to Human Keratinocytes Expressing HPV-16 E6/E7 is Related to Reduced Macrophage Inflammatory Protein-3Alpha Production

Guess, Jennifer C.; McCance, Dennis J.; Jan. 2005; 48 pp.; In English

Report No.(s): AD-A435872; CI04-1120; No Copyright; Avail: CASI; [A03](#), Hardcopy

Infection with high-risk human papillomavirus (HPV) types, particularly type 16 and 18, contributes to 90% of cervical

cancer cases. HPV infects cutaneous or mucosal epithelium, tissue that is monitored for microbial infection or damage by Langerhans cells. In lesions produced by HPV type 16, there is a reduction in immune cells, especially Langerhans cells. Langerhans precursor cells selectively express CCR6, the receptor for macrophage inflammatory protein 3alpha (MI-P3alpha), and function as potent immune responders to inflamed epithelium and initiators of the innate immune response. It has been reported that E6 and E7 of high-risk HPVs interfere with immune mediators in order to suppress the recruitment of immune cells and antiviral activities of infected cells. Here we show that HPV-16 E6 and E7 inhibit MIP-3alpha transcription resulting in suppression of the migration of immature Langerhans precursor cells. Interestingly, the E6 and E7 proteins from the low-risk HPV types also inhibited MI-P3alpha transcription. These results suggest that one mechanism by which HPV-infected cells suppress the immune response may be through the inhibition of a vital alert signal, thus, contributing to the persistence of HPV infection.

DTIC

Cells (Biology); Epidermis; Immunity; Macrophages; Migration; Proteins

20050201107 General Accounting Office, Washington, DC USA

Anthrax Detection: Agencies Need to Validate Sampling Activities in Order to Increase Confidence in Negative Results

Mar. 2005; 120 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435940; No Copyright; Avail: Defense Technical Information Center (DTIC)

In September and October 2001, contaminated letters laced with *Bacillus anthracis*, or anthrax spores, were sent through the mail to two senators, Thomas Daschle and Patrick Leahy, and members of the media. The letters led to the first cases of anthrax disease related to bioterrorism in the USA. The postal facilities in New Jersey and Washington, D.C., that processed the senators' letters became heavily contaminated. Other mail routed through these facilities, as well as additional ones in the postal network, also became contaminated. Numerous federal facilities in the Washington, D.C., area, the U.S. Supreme Court, Walter Reed Army Institute of Research, Department of Health and Human Services (HHS), and main State Department buildings were also later found to be contaminated.

DTIC

Biological Effects; Detection; Infectious Diseases; Quality Control; Sampling

20050201114 Massachusetts Inst. of Tech., Cambridge, MA USA

Optical Materials and Device Fabrication for Chemical Sensing on the Nanoscale

Nocera, Daniel G.; Wun, Aetna W.; Snee, Preston; Somers, Becky; Jul. 2005; 14 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0269

Report No.(s): AD-A435965; AFRL-SR-AR-TR-05-0299; No Copyright; Avail: CASI; [A03](#), Hardcopy

The program focus is to create new optical sensors based on bio-inspired concepts and use them for sensing applications of relevance to the USA Air Force, especially for applications in the micro- and nano-domains. This proposal seeks to unite the areas of optical chemo/bio-sensing (CB sensing) and nanoscience. As the advancement of chemical sensing systems progresses towards small length scales, sensitivity and performance are compromised because there are simply too few sensing active sites on the micro- and nano-patterned structures to permit detection of species. Accordingly, this proposal seeks to develop strategies to increase CB sensor response by replacing the linear, single photon response of present sensors with extremely nonlinear optical responses. To achieve this objective, a multi-prong approach that combines materials chemistry, engineering and optical science is presented in which the light emitting molecular centers of conventional optical chemosensors are substituted with a mesoscopic optical laser cavity of Distributed Feedback (DFB) structures and spherical cavity resonators exhibiting Whispering Gallery Modes (WGM). By tuning the frequency of the resonator to a specific property of the target biomolecule, the laser response can be interrupted upon recognition of the target at the surface of the resonator. In this way, a large change in nonlinear laser signal is easily detected upon target recognition.

DTIC

Biochemistry; Detection; Fabrication; Nanotechnology; Nonlinear Optics; Optical Materials; Optical Measuring Instruments

20050201116 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Examination of Neisseria Gonorrhoeae Opacity Protein Expression During Experimental Murine Genital Tract Infection

Simms, Amy N.; Jan. 2005; 193 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435969; No Copyright; Avail: Defense Technical Information Center (DTIC)

The opacity (Opa) proteins of *Neisseria gonorrhoeae* are a family of phase-variable outer membrane proteins that bind to

host cells. Phase variable expression occurs via a reversible frameshift mechanism within each opa gene. Opa protein expression is selected for, or induced during experimental genital tract infection of female mice, similar to that which was reported in male volunteers. Using a genetically marked strain of FA1090 to follow recovery of a specific population of Opa variants during murine infection, here we showed that selection of a pre-existing population of Opa-positive gonococci present in the inoculum was responsible for the reisolation of mainly Opa-positive variants early during infection. We conclude that the preferential recovery of Opa-positive gonococci observed early during murine infection is due to selection of a pre-existing population of Opa-positive variants caused by factors other than binding to human CEACAM receptors. In long-term infection of mice, a cyclical pattern of Opa protein expression was observed in which a decreased recovery of Opa-positive variants followed early selection for Opa protein expression; reemergence of Opa-positive gonococci occurred later in infection.

DTIC

Infectious Diseases; Opacity; Proteins; Rodents; Sites

20050201119 University of Southern Illinois, Springfield, IL USA

Mechanism of tumor Metastasis Suppression by the KAI1 Gene

Watabe, Kounosuke; Feb. 2005; 20 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0193

Report No.(s): AD-A435979; No Copyright; Avail: CASI; [A03](#), Hardcopy

Prostate cancer is the most frequently diagnosed cancer among men in the USA. It represents approximately 7% of all cancer deaths and ranks as the second leading cause of cancer death in males. The KAI1 gene was originally isolated as a prostate-specific tumor metastasis suppressor gene. Based on our preliminary data, we hypothesize that the KAI1 protein on tumor cells interacts with gp-Fy on the endothelial cells, which activates a signal-pathway of the KAI1 molecule, and that this activation eventually leads to cell growth arrest of tumor cells. To test this hypothesis, we used gp-Fy knockout mice and injected prostate tumor cells that do or do not express KAI1 gene. Our preliminary results indicate that the cancer cells expressing KAI1 are capable of attaching to vascular endothelial cells through direct interaction of KAI1 and gp-Fy proteins, and this interaction leads to inhibition of tumor cell proliferation. Our long-term goal is to elucidate the molecular mechanism of tumor suppression by the KAI1 gene and to develop an effective therapeutic method which restores the function of the KAI1 gene in the metastatic tumor cells.

DTIC

Cancer; Genes; Metastasis; Prostate Gland; Tumors

20050201124 Walter Reed Army Inst. of Research, Washington, DC USA

Development of a Genome Fingerprint Database to Identify Genetically Engineered Microbes

Lindler, Luther E.; Huang, Xiaozhe; Jan. 2002; 12 pp.; In English

Report No.(s): AD-A435992; No Copyright; Avail: Defense Technical Information Center (DTIC)

The development of recombinant DNA technology and the current state of bioscience has for the first time made the laboratory creation of new biological weapons a real possibility. A critical part of any countermeasures is the ability to identify strains that are unlike previous strains that have been isolated, i.e. are 'outside the box' of known genetic variability for the organism. A database of this type will help medical care providers plan an appropriate course of treatment and aid strategic decisions as to the possible origin of the new isolate. Such a database should be capable of including many types of data including source characterization and be capable of determining the phylogenetic relationship of any new isolate to the data contained in the database. We are using the Bionumerics software package and *Yersinia pestis* as our test organism. We examined 37 isolates from the USA (CONUS) and 20 isolates obtained from four different continents (OCONUS) that span a time period of 100 years. We examined our group of strains using a variety of techniques selective housekeeping gene sequencing and pulsed field gel electrophoresis (PFGE). We compared these methods with the established plague typing technique of ribotyping with ribosomal RNA gene probes. All of the CONUS strains belonged to a single ribotype. Chromosomal gene sequencing revealed the *Y. pestis* coding regions are highly stable and have not varied in any of the OCONUS strains. In contrast, PFGE was able to distinguish 46 strains (CONUS and OCONUS) that were derived from different parents. All CONUS strains were at least 70% similar to each other and could be divided into four groups that were greater than 90% similar.

DTIC

Data Bases; Deoxyribonucleic Acid; Genome; Microorganisms

20050201125 General Accounting Office, Washington, DC USA

U.S. Postal Service: Better Guidance Is Needed to Ensure an Appropriate Response to Anthrax Contamination

Sep. 2004; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435997; GAO-04-239; No Copyright; Avail: Defense Technical Information Center (DTIC)

In September and October 2001, at least four letters containing anthrax spores were mailed to news media personnel and two U.S. Senators, leading to the first cases of bioterrorism-related anthrax in the USA. The contaminated letters, which were delivered through the U.S. mail system, caused 22 cases of anthrax, 5 of them fatal. Nine postal employees associated with two postal facilities that processed the letters -- Trenton in New Jersey and Brentwood in Washington, D.C. -- contracted anthrax and two Brentwood employees died. The U.S. Postal Service closed Trenton and Brentwood, but other contaminated postal facilities remained open. GAO's review covers Trenton, Brentwood, and three of these other facilities. As requested, this report describes the following: (1) the factors considered in deciding whether to close the five facilities, (2) the information communicated to postal employees about health risks and the extent of the facilities' contamination, and (3) how lessons learned from the response to the contamination could be used in future situations. GAO is making recommendations to help ensure that the Postal Service has comprehensive, clear, accurate, and up-to-date guidance for any future anthrax response. The Postal Service indicated that it had taken or would take action on GAO's recommendations.

DTIC

Biological Effects; Closures; Contamination; Decision Making; Infectious Diseases; Responses

20050201127 Geo-Centers, Inc., Aberdeen Proving Ground, MD USA

Assessment of Environmentally Benign Decontaminant Towards Anthrax Spores

Rastogi, Vipin K.; Cheng, Tu-chen; Turetsky, Abe; Bartram, Phillip; Wagner, George; Jan. 2002; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435999; No Copyright; Avail: Defense Technical Information Center (DTIC)

In recent years, production and storage of CBW agents in large quantities by a number of rogue nations and extremist groups have raised the probability of their use in armed conflicts and against civilian populations around the world. While the CW agents include nerve agents, G-type and Vtype, and blistering agents such as mustard gas; the BW agents include pathogenic viruses, bacterial cells, dormant spores, and protein-based toxins. The current decontaminant used by first responders and the US armed forces is not environmentally friendly. Consequently, development of alternative decontaminants is urgently needed. Three environmentally benign decontaminant formulations, two based on hydrogen peroxide and a third based on hypochlorite, have recently been developed for CW agents. We were interested in evaluating these formulations against BW agents in a quest to develop environmentally benign CBW decontaminants. In this study, these formulations were evaluated against *Bacillus anthracis* (NNRD1 strain) spores. While, both peroxide-based formulations resulted in a 7-log reduction in spore viability, the hypochloritebased formulation was much less effective. These results provide support for continued efforts in a quest for the development of an environmentally benign universal CBW decontaminant.

DTIC

Chemical Warfare; Decontamination; Infectious Diseases; Spores

20050201779 Goettingen Univ., Germany

Molecular Processes as a Basis for Autonomous Networking

Krueger, Bettina; Dressler, Falko; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 43-50; In English; See also 20050201770; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

Autonomous networking has become the buzzword for attempts of building high-scalable network architectures, which are self-organizing, self-maintaining and self-healing. Few of these approaches were successful and none has shown to provide all the promised functions. We try to study the processes in computer networks using molecular processes as the paradigm. This novel approach shows many similarities between computer networking and cellular mechanisms. In this paper, we focus on the area of network security as one research area with high demand for high-scalable mechanisms providing the needed functionality. After identifying similarities between nature and technology, we discuss potential research domains, which are high potentials for learning directly from molecular biology using the example of security threats in communication networks. We see the proposed mechanism as a generic approach for autonomous networking. The countermeasures against attacks in computer networks are only a special example to introduce the mechanisms.

Author

Autonomy; Communication Networks; Molecular Biology

20050202013 Louisiana State Univ., Baton Rouge, LA, USA

Evaluation of Suited and Unsited Human Functional Strength Using Multipurpose, Multiaxial Isokinetic Dynamometer

Aghazadeh, Fred; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 1-12; In English; See also 20050202011; No Copyright; Avail: CASI; [A03](#), Hardcopy

The objective of the planned summer research was to develop a procedure to determine the isokinetic functional strength of suited and unsited participants in order to estimate the coefficient of micro-gravity suit on human strength. To accomplish this objective, the Anthropometry and Biomechanics Facility's Multipurpose, Multiaxial Isokinetic dynamometer (MMID) was used. Development of procedure involved selection and testing of seven routines to be tested on MMID. We conducted the related experiments and collected the data for 12 participants. In addition to the above objective, we developed a procedure to assess the fatiguing characteristics of suited and unsited participants using EMG technique. We collected EMG data on 10 participants while performing a programmed routing on MMID. EMG data along with information on the exerted forces, effector speed, number of repetitions, and duration of each routine were recorded for further analysis. Finally, gathering and tabulation Of data for various human strengths for updating of MSIS (HSIS) strength requirement, which started in summer 2003, also continued.

Author

Control Equipment; Microgravity; Dynamometers; Anthropometry; Biodynamics

20050202026 Wisconsin Univ., Milwaukee, WI, USA

Physics-based Simulation of Human Posture Using 3D Whole Body Scanning Technology for Astronaut Space Suit Evaluation

Kim, Kyu-Jung; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 13-1 - 13-8; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A02](#), Hardcopy

Over the past few years high precision three-dimensional (3D) full body laser scanners have been developed to be used as a powerful anthropometry tool for quantification of the morphology of the human body. The full body scanner can quickly extract body characteristics in non-contact fashion. It is required for the Anthropometry and Biomechanics Facility (ABF) to have capabilities for kinematics simulation of a digital human at various postures whereas the laser scanner only allows capturing a single static posture at each time. During this summer fellowship period a theoretical study has been conducted to estimate an arbitrary posture with a series of example postures through finite element (FE) approximation and found that four-point isoparametric FE approximation would result in reasonable maximum position errors less than 5%. Subsequent pilot scan experiments demonstrated that a bead marker with a nominal size of 6 mm could be used as a marker for digitizing 3-D coordinates of anatomical landmarks for further kinematic analysis. Two sessions of human subject testing were conducted for reconstruction of an arbitrary postures from a set of example postures for each joint motion for the forearm/hand complex and the whole upper extremity.

Author

Optical Scanners; Anthropometry; Human Body; Laser Applications; Biodynamics; Finite Element Method; Kinematics

20050202032 Missouri Univ., Saint Louis, MO, USA

Adaptable Constrained Genetic Programming: Extensions and Applications

Janikow, Cezary Z.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 11-1 - 11-7; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A02](#), Hardcopy

An evolutionary algorithm applies evolution-based principles to problem solving. To solve a problem, the user defines the space of potential solutions, the representation space. Sample solutions are encoded in a chromosome-like structure. The algorithm maintains a population of such samples, which undergo simulated evolution by means of mutation, crossover, and survival of the fittest principles. Genetic Programming (GP) uses tree-like chromosomes, providing very rich representation suitable for many problems of interest. GP has been successfully applied to a number of practical problems such as learning Boolean functions and designing hardware circuits. To apply GP to a problem, the user needs to define the actual representation space, by defining the atomic functions and terminals labeling the actual trees. The sufficiency principle requires that the label set be sufficient to build the desired solution trees. The closure principle allows the labels to mix in any arity-consistent manner. To satisfy both principles, the user is often forced to provide a large label set, with ad hoc interpretations or penalties to deal with undesired local contexts. This unfortunately enlarges the actual representation space, and thus usually slows down the search. In the past few years, three different methodologies have been proposed to allow the

user to alleviate the closure principle by providing means to define, and to process, constraints on mixing the labels in the trees. Last summer we proposed a new methodology to further alleviate the problem by discovering local heuristics for building quality solution trees. A pilot system was implemented last summer and tested throughout the year. This summer we have implemented a new revision, and produced a User's Manual so that the pilot system can be made available to other practitioners and researchers. We have also designed, and partly implemented, a larger system capable of dealing with much more powerful heuristics.

Author

Problem Solving; Algorithms; Heuristic Methods; Chromosomes; Genetics

20050203823 Wayne State Univ., Detroit, MI, USA

Deciphering the Enigma of Human Creativity: Can A Digital Computer Think?

Hong, Felix T.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 18 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Abstract It is possible to understand how scientific geniuses made discoveries, if we treat the paths leading to a discovery as a process of pattern recognition and we further recognize that there are two different modes of reasoning that can be used to generate solutions but are used by highly creative and less creative individuals with different proportions: visual thinking and verbal thinking. The power of visual thinking lies in its inherent parallel processing and random access. These feature can explain why geniuses often had no clue as to how the solution had been arrived at. Intuition, which is intimately related to parallel processing and visual thinking, is so difficult to articulate since articulation is a sequential process, and a suitable parallel-to-serial conversion must be sought for in advance. However, the pitfalls of visual thinking include liability to additional errors and a lack of objectivity. However, potential solutions discovered by visual thinking must be strictly verified by logical reasoning, which is sequential and inherently verbal in nature. When the latter is done properly, it is highly objective and less error-prone, and can eliminate most errors incurred at the stage of solution generation. There is no straight answer to the question whether a digital computer can think, because there is a gray scale of thinking and understanding. Taking Herbert Simon's programs as examples, we found that some of these programs did indeed surpass the intellectual performance of a special class of human being: the so-called high achievers who are strong in taking standardized tests but weak in formulating ideas to solve problems that have not been taught previously or covered in the textbook. But human geniuses seemed so far to be able to stay one step ahead of these programs, because Simon's programs were constructed by pooling together thinking strategies of many past creators, so as to generate heuristics. As for the creative performance of future computers, it is better to suspend our judgment. Science and technology history taught us a lesson: never say never, except perhaps just this once.

Author

Digital Computers; Parallel Processing (Computers); Mental Performance

20050203831 Belgrade Univ., Yugoslavia

A Method For Brain Electrical Activity Visualization

Bojovic, Ivan; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004], pp. 1-7; In English; See also 20050203815; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Brain electrical activity manifests itself by creating electromagnetic field that extends through skull to scalp. Thus, this field could be recorded on scalp using appropriate electrodes and measured potential values could be used to analyze brain activity. This kind of analysis is denoted by term electroencephalography (EEG). Fast development of computer equipment made possible conducting analysis and visualization of EEG values on personal computers, bringing many advantages over classical methods. New methods for visual representation of EEG scores are especially active field of research during last time. Development of fast graphics accelerators made possible two- and even three-dimensional visualizations of EEG scores. This paper presents software named Tempo3 for three-dimensional visualization of brain electrical activity over realistic model of human head. This software is first to make possible alike visualization of raw EEG potentials in real time. Software is also designed as a modular environment that could be extended with support for further types of EEG analysis.

Author

Brain; Electroencephalography; Real Time Operation

20050203838 NASA Glenn Research Center, Cleveland, OH, USA

MRI-Based Computational Fluid Dynamics in Experimental Vascular Models: Toward the Development of an Approach for Prediction of Cardiovascular Changes During Prolonged Space Missions

Spirka, T. A.; Myers, J. G.; Setser, R. M.; Halliburton, S. S.; White, R. D.; Chatzimavroudis, G. P.; [2005]; 1 pp.; In English; 13th Annual Meeting and Exposition, 7-13 May 2005, Southbeach, FL, USA

Contract(s)/Grant(s): NCC3-1077; WBS 22-101-51-14; Copyright; Avail: CASI; [A01](#), Hardcopy

A priority of NASA is to identify and study possible risks to astronauts health during prolonged space missions [1]. The goal is to develop a procedure for a preflight evaluation of the cardiovascular system of an astronaut and to forecast how it will be affected during the mission. To predict these changes, a computational cardiovascular model must be constructed. Although physiology data can be used to make a general model, a more desirable subject-specific model requires anatomical, functional, and flow data from the specific astronaut. MRI has the unique advantage of providing images with all of the above information, including three-directional velocity data which can be used as boundary conditions in a computational fluid dynamics (CFD) program [2,3]. MRI-based CFD is very promising for reproduction of the flow patterns of a specific subject and prediction of changes in the absence of gravity. The aim of this study was to test the feasibility of this approach by reconstructing the geometry of MRI-scanned arterial models and reproducing the MRI-measured velocities using CFD simulations on these geometries.

Derived from text

Cardiovascular System; Computational Fluid Dynamics; Space Missions; Forecasting; Health; Predictions

20050203857 NASA Stennis Space Center, Stennis Space Center, MS, USA

An Automated Flying-Insect-Detection System

Vann, Timi; Andrews, Jane C.; Howell, Dane; Ryan, Robert; [2005]; 4 pp.; In English

Contract(s)/Grant(s): NAS13-650; SSC-00192

Report No.(s): NASA/NP-2005-07-00066-SSC; No Copyright; Avail: CASI; [A01](#), Hardcopy

An automated flying-insect-detection system (AFIDS) was developed as a proof-of-concept instrument for real-time detection and identification of flying insects. This type of system has use in public health and homeland security decision support, agriculture and military pest management, and/or entomological research. Insects are first lured into the AFIDS integrated sphere by insect attractants. Once inside the sphere, the insect's wing beats cause alterations in light intensity that is detected by a photoelectric sensor. Following detection, the insects are encouraged (with the use of a small fan) to move out of the sphere and into a designated insect trap where they are held for taxonomic identification or serological testing. The acquired electronic wing beat signatures are preprocessed (Fourier transformed) in real-time to display a periodic signal. These signals are sent to the end user where they are graphically displayed. All AFIDS data are pre-processed in the field with the use of a laptop computer equipped with LABVIEW. The AFIDS software can be programmed to run continuously or at specific time intervals when insects are prevalent. A special DC-restored transimpedance amplifier reduces the contributions of low-frequency background light signals, and affords approximately two orders of magnitude greater AC gain than conventional amplifiers. This greatly increases the signal-to-noise ratio and enables the detection of small changes in light intensity. The AFIDS light source consists of high-intensity Al GaInP light-emitting diodes (LEDs). The AFIDS circuitry minimizes brightness fluctuations in the LEDs and when integrated with an integrating sphere, creates a diffuse uniform light field. The insect wing beats isotropically scatter the diffuse light in the sphere and create wing beat signatures that are detected by the sensor. This configuration minimizes variations in signal associated with insect flight orientation.

Derived from text

Insects; Entomology; Detection; Classifiers; Differentiation (Biology)

20050203892 Purdue Univ., West Lafayette, IN, USA, IPSI Belgrade Ltd., Belgrade, Serbia

Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004)

[2004]; In English; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility and Related Issues, 8-11 Jul. 2004, West Lafayette, IN, USA; See also 20050203893 - 20050203959; Copyright; Avail: CASI; [C01](#), CD-ROM

Contents include the following: Analysis of social science theory through computerization of representation in formal logic. Global optimization for optical coating design. Autonomy for system assurance under evolving situations. Probing neural synchronization in psychiatric disorders. A new image of the cochlea and hearing. Building high performance mail memory web databases. Problems and prospects for e-manufacturing.

CASI

Optical Materials; Sociology; Synchronism; Internets; Hearing

20050203902 Sheffield Univ., UK

Life in Unusual Places

Wainwright, M.; Al-Harbi, S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 9 pp.; In English; See also 20050203892; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Microbes exist almost everywhere on Earth in the extremely hot waters adjacent to hydrothermal vents and in the freezing wastes of Antarctica. Recently, claims suggest that microbes can also exist in some unusual environments, such as the stratosphere and can lie dormant for millions of years in amber and ancient salt crystals. The existence of life in the form of microbes in these environments fundamentally challenges many of our current views on the origin of life, evolution and the origin of some of the so-called emerging diseases.

Author

Extraterrestrial Life; Molecular Biology; Biological Evolution; Microorganisms

20050203909 Worldnet, USA

E-Psychiatry and the Online Treatment Paradigm

Gibson, Mitchell G.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The delivery of quality mental health services to isolated and physically challenged populations has long been a problematic issue in psychiatry. With the advent of psychiatric service providers via the Internet (e-psychiatry), this dilemma may now be addressed. However, the primary treatment paradigms have not been well established and the resolution of issues such as relatedness, transference, cost, safety, legal issues and efficacy are central to the success of any effective online therapeutic relationship. In this paper I will examine these core issues that plague the fledgling field of e-psychiatry. I will also examine the strengths and weaknesses of several solutions to these problems in the clinical psychiatric setting.

Author

Mental Health; Psychiatry; Therapy; Medical Services

20050203923 ITIS doo, Ljubljana, Slovenia

Modulation of a Dog's Internal Organ Function by Selective Stimulation of the Left Vagus Nerve

Rozman, J.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains black and white illustrations

Contract(s)/Grant(s): HPRN-CT-2000-00030; J2-0542; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The superficial regions of the left vagus nerves of a dog were selectively stimulated with 39-electrode spiral cuffs having thirteen circumferential groups of three electrodes (GTE) to modulate the function of the innervated internal organs and glands. Under general anaesthesia, the cuffs were chronically implanted on the nerve at the neck in two adult Beagle dogs. The regions were stimulated with biphasic, rectangular and current pulses (2mA, 200ms, 20Hz) delivered to the group of GTE being close to the region innervating the specific internal organ or gland. The results showed that GTE No. 9 elicited the highest influence on the heart function, GTE No. 4 elicited the highest influence on breathing, GTE No. 1 elicited the highest influence on the pressure within the bladder, and GTE No. 7 elicited the most acidic gastric juice within the stomach. It was also shown that GTE No. 10 significantly modified the endocrine function of the pancreas. Results of this study clearly demonstrate that internal organs and glands can be selectively stimulated via the selective stimulation of innervating superficial regions of the autonomous peripheral nerve.

Author

Dogs; Electrodes; Heart Function; Nerves; Organs; Stimulation; Autonomic Nervous System; Modulation

20050203924 Research Inst. of Ear, Throat, Nose and Speech, Saint Petersburg, Russia

Interdisciplinary Research and Speech Rhythm

Skljarov, Oleg; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The new definition of speech rhythm is given. This definition is based on the principle of segmentation: Voiced segment Unvoiced segment. The rhythm is defined as sequence of these segments' durations. Set of normalised durations is the point set on interval. Owing to established in paper fact that the rhythm evolution is described as the logistic mapping on this set, in the offered paper the dynamic regimes of the rhythm in both normal speech and stuttering speech are described. It is shown that such definition of the rhythm is physiologically plausible in contrast to earlier reported models and allows to explain the nature of stuttering which did not find explanation up to now. Moreover, within the framework of the offered mathematical model the causes which change these rhythm regimes are established. It allowed to apply in clinic optimal course of treatment for each stutterer individually. Such individual optimum course will allow to avoid the basic shortcoming in clinic of stuttering - group method of correction. In turn it gave us the possibility for carrying out individual studies with the patients with help of the Internet.

Author

Research; Mathematical Models; Voice Communication; Speech Defects

20050203937 Ethnoveterinary Medicine Unit, Dar es Salaam, Tanzania, United Republic of
Conservation and Establishment of Medicinal Plants in Backyard Home Gardens in Tanzania

Minja, M Kangare M. J.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The majority of plants used in ethnomedical and ethnoveterinary practices in Tanzania are mainly harvested from the wild. The growing demand for medicinal plants calls for enhanced conservation strategies. In order to ensure that representative wild populations of vulnerable medicinal plant species are conserved, there should be efforts aimed at establishing sustainable medicinal plants base in the form of backyard home gardens, to satisfy the health needs of both man and animals. Backyard home gardens serve as alternative supply sources through cultivation in large enough quantities and at a low enough prices to compete with prices obtained by gatherers of wild stocks.

Author

Conservation; Tanzania; Plants (Botany); Clinical Medicine

20050203938 Center for Sensory Processes, Green Lane, PA, USA
A New Image of the Cochlea and Hearing

Offutt, George; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 4 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The ear is assumed to be exclusively sensitive to mechanical stimuli. However, this assumption that the cochlea receptors are only mechanically sensitive is based in part upon a hypothesis that uses a negative argument. Stevens (1937) and others had shown that hearing was evoked by electrical stimulation in the head region. However, he wrote concerning the sensing of electrical stimulation as sound that 'Here again we have an hypothesis demanding a mechanism for whose existence we are completely without evidence'. In 1937, Stevens's negative argument was true and there was no known receptor of electrical potentials. However, as with so many negative arguments, time and further investigations have also shown that Steven's negative argument was not valid. We now know of many types of hair cells that are very sensitive electroreceptors. Thus, the assumption of an exclusive mechanical sensitivity in the cochlea is flawed because it is based in part upon Stevens's negative argument and hypothesis.

Derived from text

Cochlea; Detection; Stimulation; Hearing

20050203942 Ben Gurion Univ. of the Negev, Beersheva, Israel
E-Learn and New Curricula in Biomedical Engineering

Shani, Gad; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Medicine has become very technological. Doctor s offices, clinics and hospital rooms are loaded with electronic devices

where modern sensors are linked to computers which receive the measured signals from the patient body, store them in memory and perform data analysis immediately. The new developments in electronics and material science resulted in new, compact, sensitive sensors. The miniaturization of computers, the ability of built-in large memory in a small volume, changed the shape of the medical clinic. In remote areas the signals are sent via telephone lines to medical centers for analysis and experts interpretation. Results are presented in a very clear and understandable manner. This change in the medical world brought about a great demand for medical engineers capable of developing, maintaining and operating those new devices. The curriculum in biomedical engineering must be changed accordingly. E-learn became the major facility in the modern biomedical engineer education. Data stored in computers saves many laboratory hours and live demonstrations. The use of laboratory animals is reduced. Anatomy and physiology are now taught on computer screens, virtual operations are done in classrooms. Computer simulators can now learn, teach and investigate many of the human functions. Some of those are discussed in this article.

Author

Bioengineering; Clinical Medicine; Education; Biotechnology

20050203944 Cleveland Clinic, Cleveland, OH, USA

Peri-Operative Medicine: Unrecognised Sleep Apnea in Perioperative Patient Population

Kaw, R.; Golish, J.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 9 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The symptomatology of sleep apnea may be difficult to distinguish from normal variations in sleep behaviour. Clinical examination carries a sensitivity & specificity of only 50-60% for definitive diagnosis of sleep apnea even by experienced sleep physicians. As such patients with sleep apnea may present for surgery without a prior diagnosis. Data from the Wisconsin Sleep Cohort Study estimate that 2% of women and 4% of men in the middle-aged work force meet the minimal diagnostic criteria for the sleep apnea syndrome. Obstructive sleep apnea is more common in patients presenting for surgery, 1- 9% incidence, although the more severe forms are less common. 1a Sleep apnea is defined as a pause of more than 10 s in breathing during sleep and OSA is defined as at least five apneas per hour. A clinical suspicion of sleep apnea may first develop at the preoperative consultation, intra-operatively if the patient proves difficult to intubate or maintenance of airway is difficult or postoperatively with observed snoring and obstruction. Airway obstruction out of proportion to the apparent degree of sedation may suggest undiagnosed sleep apnea. Presence of unexplained respiratory or right heart failure or polycythaemia might also point to undiagnosed and severe sleep apnea.

Author

Signs and Symptoms; Sleep; Surgery; Symptomology

20050203949 Indiana Univ., Bloomington, IN, USA

Probing Neural Synchronization in Psychiatric Disorders

O'Donnell, Brian F.; Krishnan, Giri P.; Vohs, Jennifer; Bockbrader, Marcia; Hetrick, William P.; Shekhar, Anantha; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 23 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Neurophysiological evidence suggests that neural synchronization enables integration of information within the brain. These effects are most prominent at relatively high frequencies of neural oscillation, often referred to as the gamma range (25 Hz and higher). It is possible that psychiatric disorders which affect neurotransmission in the brain may be associated with disturbed neural synchronization. Electroencephalographic (EEG) recording allows non-invasive evaluation of the frequency response of the human brain to temporally modulated stimulation. We report findings from a series of studies that show abnormal EEG synchronization in schizophrenia and bipolar disorder, two disorders which impair coherent thought and emotional responses. Disturbances in neural synchronization may contribute to disorganized cognition and behavior which are common in these mental disorders.

Author

Brain; Neurophysiology; Psychiatry; Synchronism; Electroencephalography; Disorders

20050203959 MedSMART, Inc., Ann Arbor, MI, USA

Stroke in the Computer or Pie in the Sky: The Need for Advanced Computing and Information Technology in the Search for the Treatment of Brain Disorders

vonLubitz, Dag K. J. E.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 12 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Despite intense bench and clinical research, the majority of brain disorders cannot be effectively cured. The complexity of the brain compounded by the complexity of the involved pathophysiologies result in continuing failures of clinical trials testing therapeutic approaches that show high promise in simple models of disease. Computer-based modeling has been applied to the analysis of other ultra-complex systems in physics, astronomy, engineering, etc. It is the belief of the author that similar approach to the pathology of the brain may offer a highly promising approach to better understanding of the involved processes, their relationships, and, ultimately to the development of effective and less costly therapeutic interventions.

Author

Clinical Medicine; Disorders; Computers; Brain Damage; Pathology

52

AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20050200847 Air Force Research Lab., Brooks AFB, TX USA

Scheduling Aircrews 2: Nighttime Missions

Miller, James C.; May 2005; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A435393; AFRL-HE-BR-TR-2005-0075; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this Memorandum was to develop aircrew work-rest guidance that deals with the shift lag issues associated with nighttime missions; for example, scheduling night-vision-goggle training sorties. It was hoped that this guidance could be used by operational commanders to determine when best to employ their crews. The calculations in this TM were based upon the U.S. Department of Defense Sleep, Activity, Fatigue, and Task Effectiveness (SAFTE) applied model. The SAFTE applied model integrated the effects of length of prior wakefulness, amount of sleep and circadian rhythm. This applied model was implemented in the Windows program, Fatigue Avoidance Scheduling Tool (FAST(trademark), NTI Inc., Dayton OH), which was used to make the calculations and to draw the figures shown in this Memorandum. Guidance was presented for military aviation training missions by the quarter of the day. 'Evening' missions generally operate within the period 1800-0000h and allow crews to accomplish their night approaches, landings and other required training, such as operations with NVGs. Occasionally, 'night' missions are flown in the 0000-0600h period. Discussions were presented for flying before midnight (evening missions), flying after midnight (night missions), acclimation to permanent night missions, and re-acclimation to day work.

DTIC

Flight Crews; Night; Scheduling; Sleep

20050201110 Army Research Inst. of Environmental Medicine, Natick, MA USA

Development of a Rat Model of Hypothermia

DuBose, David A.; Morehouse, David H.; Rufolo, Dennis; Blaha, Michael; Leon, Lisa R.; Jun. 2005; 36 pp.; In English
Report No.(s): AD-A435953; USARIEM/TMMD-T05-06; No Copyright; Avail: Defense Technical Information Center (DTIC)

Hypothermia can significantly impact the outcome of military missions, since it is a seasonal and geographic pervasive physiological phenomenon that reduces not only soldier performance, but may lead to their death. Moreover, military operational stress (MOS) such as exhaustive exercise, caloric restriction and sleep deprivation may enhance soldier vulnerability to hypothermia. Understanding the full influence of MOS on hypothermia morbidity and mortality requires an animal model, since ethical considerations in regards to their health preclude the use of human volunteers. A model of

hypothermia was developed that employed rates (male; Sprague-Dawley; 250.5 +/- 7.3 g) immediately exposed to circulating (0.7 +/- 0.3 L/min) cool (10 degrees C) water at a non-full immersion depth of 5 cm. During exposure to cool/wet conditions animals assumed a water avoidance posture of an upright position such that only their hindquarters were exposed to the water. Moderate hypothermia (32 +/- 3 degrees C) was induced within a 2 to 4h timeframe in which animal activity and, core (Tc) and brown adipose tissue (BAT) temperature could be monitored. Thermoregulatory temperature profiles for hypothermia induction and recovery were variable among the animals. Markers of hypothermia induction and recovery were identified as: 1)lowest hypothermia Tc; 2)time to lowest hypothermia Tc; 3) thermoregulatory maintenance time post lowest hypothermia Tc; 4)cooling rate; 5) 37 degrees C Tc recovery time from lowest hypothermia Tc; 6)re-warming rate and 7)length of BAT thermogenic response. This rat model features a hypothermia induction vehicle (immediate cool water exposure) and vehicle exposure pattern (lower extremities) that reflects the militarily relevant scenario of sudden soldier exposure to waist-deep cool water. Its military relevance in make this model well suited to characterize the influence of MOS on hypothermia morbidity and mortality.

DTIC

Hypothermia; Military Operations; Models; Rats

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20050202011 NASA Johnson Space Center, Houston, TX, USA

NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2

Hyman, William A., Editor; Sickorez, Donn G., Editor; Leveritt, Dawn M., Editor; August 2005; 339 pp.; In English; See also 20050202012 - 20050202034

Contract(s)/Grant(s): NGT9-1526; NNJ04JF93A; NAG9-1526

Report No.(s): NASA/CR-2005-213690/VOL1/2; S-961/VOL1/2; No Copyright; Avail: CASI; [A15](#), Hardcopy

The objective of the planned summer research was to develop a procedure to determine the isokinetic functional strength of suited and unsuited participants in order to estimate the coefficient of micro-gravity suit on human strength. To accomplish this objective, the Anthropometry and Biomechanics Facility Multipurpose, Multiaxial Isokinetic dynamometer (MMID) was used. Development of procedure involved selection and testing of seven routines to be tested on MMID. We conducted the related experiments and collected the data for 12 participants. In addition to the above objective, we developed a procedure to assess the fatiguing characteristics of suited and unsuited participants using EMG technique. We collected EMG data on 10 participants while performing a programmed routing on MMID. EMG data along with information on the exerted forces, effector speed, number of repetitions, and duration of each routine were recorded for further analysis. Finally, gathering and tabulation Of data for various human strengths for updating of MSIS (HSIS) strength requirement, which started in summer 2003, also continued.

Author

Anthropometry; Biodynamics; Electromyography; Microgravity

20050203835 Ljubljana Univ., Ljubljana, Slovenia

Corruption and Ethics in the Public Service

Strmecki, Mik; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 9 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

I will start off by a passage from John Stuart Mill which goes as follows: 'We need not suppose that when power resides in an exclusive class, that class will knowingly and deliberately sacrifice the other classes to themselves, it suffices that, in the absence of its natural defenders; the interest of the excluded is always in danger of being overlooked, and, when looked at, is seen with very different eyes from those of the persons whom it directly concerns'. It is curious to note that those, who make the cultural argument in abetting corruption, often neglect to say exactly where unalloyed ethically permissive cultures are extant. Some critics voice their objection to a more strict stance on these matters in that the nations in transition cannot always afford luxuries such as an ethically - conscious administrative class, and they offer counter-arguments based on the notion that the idea of equality before the law, which is basically at stake here, must sometimes take a back seat to the exigency of economic expansion. The assumption behind this kind of argument is that right of any sort always means entitlement. If for example Italy could for a lengthy period of time pull itself out of poverty and cater for its people's needs by practicing some

calculus wherein economic development was pushed at the expense of tolerating a degree of discrimination, which is what corruptive practices in the last instance boil down to, one might be tempted to moderate one's approbium.

Derived from text

Economic Development; Ethics

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20050200956 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Domestic Preparedness Program: Phase 2 Sarin (GB) and Distilled Sulfur Mustard (HD) Vapor Challenge Testing of Commercial Self-Contained Breathing Apparatus Facepieces

Lins, Raymond R.; Campbell, Lee E.; Mar. 2005; 18 pp.; In English

Report No.(s): AD-A435639; ECBC-TR-401; No Copyright; Avail: CASI; [A03](#), Hardcopy

Results of performance testing of three types of commercial self-contained breathing apparatus (SCBA) facepieces are described. A series of tests were performed to determine sarin (GB) and distilled sulfur mustard (HD) vapor breakthrough of SCBA facepieces using manikin head form and simulated breathing.

DTIC

Breathing Apparatus; Distillation; Evaluation; Sulfur; System Effectiveness; Vapors

20050201105 Army Soldier and Biological Chemical Command, Aberdeen Proving Ground, MD USA

Evaluation of Personal Chemical Vapor Protection for Patrol and Tactical Law Enforcement

Fedele, Paul D.; Lake, William L.; Arca, Victor J.; Marshall, Stephen M.; Mitchell, David B.; Jan. 2002; 8 pp.; In English
Report No.(s): AD-A435926; No Copyright; Avail: Defense Technical Information Center (DTIC)

In Domestic Preparedness efforts, the US Army Soldier and Biological Chemical Command and the Maryland State Police, have evaluated personal chemical protective systems for use in patrol and tactical functions in law enforcement. Various Level C, impermeable and charcoal impregnated, vapor-absorptive, air-permeable protective clothing ensembles, worn with the MSA Millennium respiratory protective mask/butyl hood, and seven-mil butyl rubber gloves, have been considered. In cooperation with the Maryland State Police Special Tactical Assault Team Element (STATE), these ensembles were tested using the man-in-simulant test (MIST) processes. The test results have been used to indicate the chemical hazards that protective system users can be expected to encounter, should they operate in chemical warfare agent vapor contamination. This information is helping law enforcement personnel select personal chemical protective equipment and design chemical incident response plans that can successfully manage chemical warfare agent risks.

DTIC

Chemical Warfare; Law (Jurisprudence); Patrols; Protection; Protective Clothing; Vapors

20050201113 Army Research Inst. of Environmental Medicine, Natick, MA USA

WBGT Index Temperature Adjustments for Work/Rest Cycles When Wearing NBC protective Clothing or Body Armor

Cadarette, Bruce S.; Matthew, William T.; Sawka, Michael N.; Jun. 2005; 25 pp.; In English

Report No.(s): AD-A435964; USARIEM/TMMD-TN05-04; No Copyright; Avail: Defense Technical Information Center (DTIC)

Temperature offsets to the wet bulb, globe temperature index (WBGT), used to provide guidance for work/rest cycles and fluid replacement for Soldiers in the field wearing standard military uniforms, were developed for increased heat stress wearing protective equipment. This report details how those offsets were determined, and shows the basis for the revised offsets in the current TBMED 507. A computer simulation (USARIEM-EXP) was used to calculate core temperatures in a Soldier wearing the Hot Weather BDU, MOPP 1, and MOPP 4 at a WBGT temperature of 86 degrees F, at two work intensities. Core temperature responses at lower WBGT temperatures were then simulated until the core temperature for Soldiers in MOPP 4 was equivalent to that in the BDU at WBGT 86 degrees F. Similar comparisons were made for soldiers wearing the BDU with body armor in compensable and uncompensable hot environments. Findings indicate that compared to wearing only the BDU, WBGT temperatures should be offset by: (1) + 10 degrees F at light work in MOPP 4, (2) + 20

degrees F at moderate work in MOPP 4, (3) no adjustment if skin is dry in body armor with the BDU, and (4) + 5 degrees F if skin is wet in body armor with the BDU.

DTIC

Armor; Cycles; Military Personnel; Protective Clothing

20050201628 Naval Postgraduate School, Monterey, CA USA

The Effects of Posture, Body Armor and Other Equipment on Rifleman Lethality

Kramlich, Gary R., II; Jun. 2005; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435486; No Copyright; Avail: Defense Technical Information Center (DTIC)

How does body armor and posture affect Soldier marksmanship? The Interceptor Body Armor (IBA) has significantly improved Soldier combat survivability, but in what ways does it change rifleman lethality? Moreover, can we model these effects so as to develop better tactics and operational plans? This study quantifies the effects of Soldier equipment on lethality through multi-factor logistic regression using data from range experiments with the 1st Brigade, 1st Infantry Division (Mechanized), at Fort Riley, Kansas. The designed experiment of this study estimates the probability of a qualified US rifleman hitting a human target. It uses the rifleman's equipment, posture, Military Occupational Specialty (MOS), and experience along with the target's distance, time exposure and silhouette presentation as input factors. The resulting family of mathematical models provides a Probability of Hit prediction tailored to a shooter-target scenario. The study shows that for targets closer than 150 meters, Soldiers shot better while wearing body armor than they did without. Body armor had a negative effect for targets farther than 200 meters, and this could significantly impact the employment of the Squad Designated Marksman. The study also shows that the kneeling posture is an effective technique and recommends standardized training on this method of firing.

DTIC

Armor; Lethality; Military Technology; Posture

20050201945 Occupational Safety and Health Administration, Washington, DC, USA

Guidelines for Retail Grocery Stores: Ergonomics for the Prevention of Musculoskeletal Disorders

January 2004; 32 pp.; In English

Report No.(s): PB2005-109397; OSHA-3192-06N; No Copyright; Avail: CASI; [A03](#), Hardcopy

OSHA's Ergonomics for the Prevention of Musculoskeletal Disorders: Guidelines for Retail Grocery Stores provide practical recommendations to help grocery store employers and employees reduce the number and severity of injuries in their workplaces. Many of the work related injuries and illnesses experienced by grocery store workers are musculoskeletal disorders (MSDs), such as back injuries and sprains or strains that may develop from various factors, including lifting, repetitive motion disorders such as carpal tunnel syndrome, or injuries resulting from overexertion. MSDs may also be caused partly or wholly by factors outside of work. More remains to be learned about the relationship between workplace activities and the development of MSDs. However, OSHA believes that the experiences of many grocery stores provide a basis for taking action to better protect workers. As the understanding of these injuries develops and information and technology improve, the recommendations made in this document may be modified. Grocery stores that have implemented injury prevention efforts have said they have successfully reduced work-related injuries and workers compensation costs. Many times, these efforts have reduced injuries and led to increased worker efficiency and lowered operating costs. For example, designing checkstands to reduce ergonomic risk factors such as twisting or extended reaching can improve cashier effectiveness and productivity. The purpose of these voluntary guidelines is to build on the progress that the grocery store industry has made in addressing causes of work-related injuries and illnesses. These guidelines are intended only for retail grocery stores and combined full-line supermarket and discount merchandisers including warehouse retail establishments. The discussion is intended primarily for grocery store managers and store employees, but may also be useful for corporate managers or corporate safety professionals. OSHA did not develop these guidelines to address warehouses, convenience stores, or business operations that may be located within grocery stores, such as banks, post offices, or coffee shops. However, operations in retail or distribution that involve similar tasks or operations as those addressed in these guidelines may find the information useful.

NTIS

Health; Human Factors Engineering; Musculoskeletal System; Prevention; Safety

20050201951 Ohio Univ., Athens, OH, USA

Human Factors Opportunities to Improve Ohio's Transportation System

Zwahlen, H. T.; Oner, E.; Badurdeen, F. F.; Jun. 2005; 330 pp.; In English

Report No.(s): PB2005-107642; No Copyright; Avail: CASI; [A15](#), Hardcopy

The aim of this study was to identify opportunities to apply human factors principles and research to improve Ohio's transportation system. The Office of Traffic Engineering assigned thirteen topic areas to provide information and the study was limited to these topics even though there may have been other areas that are important from a human factors perspective. The topic areas included: rumble strips; changeable message signs (CMS); work zone delineation; half-size pavement markings; accident mitigation; older drivers; signal operations; highway lighting; curve delineation; wet/dark delineation; raised pavement markings (RPM); information dissemination; and work zone safety. The aim was to identify opportunities to improve each of these areas by providing the human factors rationale and make recommendations to ODOT that can be adopted to improve Ohio's transportation system.

NTIS

Human Factors Engineering; Ohio; Transportation

20050202025 Arkansas Technical Univ., Russellville, AR, USA

Real-Time Analysis of Electrocardiographic Data for Heart Rate Turbulence

Greco, E. Carl, Jr.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 8-1 - 8-13; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Episodes of ventricular ectopy (premature ventricular contractions, PVCs) have been reported in several astronauts and cosmonauts during space flight. Indeed, the 'Occurrence of Serious Cardiac Dysrhythmias' is now NASA's #1 priority critical path risk factor in the cardiovascular area that could jeopardize a mission as well as the health and welfare of the astronaut. Epidemiological, experimental and clinical observations suggest that severe autonomic dysfunction and/or transient cardiac ischemia can initiate potentially lethal ventricular arrhythmias. On earth, Heart Rate Turbulence (HRT) in response to PVCs has been shown to provide not only an index of baroreflex sensitivity (BRS), but also more importantly, an index of the propensity for lethal ventricular arrhythmia. An HRT procedure integrated into the existing advanced electrocardiographic system under development in JSC's Human Adaptation and Countermeasures Office was developed to provide a system for assessment of PVCs in a real-time monitoring or offline (play-back) scenario. The offline heart rate turbulence software program that was designed in the summer of 2003 was refined and modified for 'close to' real-time results. In addition, assistance was provided with the continued development of the real-time heart rate variability software program. These programs should prove useful in evaluating the risk for arrhythmias in astronauts who do and who do not have premature ventricular contractions, respectively. The software developed for these projects has not been included in this report. Please contact Dr. Todd Schlegel for information on acquiring a specific program.

Author

Electrocardiography; Real Time Operation; Epidemiology; Cardiovascular System; Autonomic Nervous System; Contraction

20050202029 Houston Univ., TX, USA

Systems Engineering and Integration for Advanced Life Support System and HST

Kamarani, Ali K.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 12-1 - 12-17; In English; See also 20050202011; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

Systems engineering (SE) discipline has revolutionized the way engineers and managers think about solving issues related to design of complex systems: With continued development of state-of-the-art technologies, systems are becoming more complex and therefore, a systematic approach is essential to control and manage their integrated design and development. This complexity is driven from integration issues. In this case, subsystems must interact with one another in order to achieve integration objectives, and also achieve the overall system's required performance. Systems engineering process addresses these issues at multiple levels. It is a technology and management process dedicated to controlling all aspects of system life cycle to assure integration at all levels. The Advanced Integration Matrix (AIM) project serves as the systems engineering and integration function for the Human Support Technology (HST) program. AIM provides means for integrated test facilities and personnel for performance trade studies, analyses, integrated models, test results, and validated requirements of the integration of HST. The goal of AIM is to address systems-level integration issues for exploration missions. It will use an incremental systems integration approach to yield technologies, baselines for further development, and possible breakthrough concepts in the areas of technological and organizational interfaces, total information flow, system wide controls, technical synergism, mission operations protocols and procedures, and human-machine interfaces.

Author

Systems Engineering; Complex Systems; Life Support Systems; Systems Integration; Support Systems; Protocol (Computers); Numerical Integration; Information Flow

20050202034 Rutgers Univ., New Brunswick, NJ, USA

Advanced Water Recovery Technologies for Long Duration Space Exploration Missions

Liu, Scan X.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 16-1 - 16-15; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Extended-duration space travel and habitation require recovering water from wastewater generated in spacecrafts and extraterrestrial outposts since the largest consumable for human life support is water. Many wastewater treatment technologies used for terrestrial applications are adoptable to extraterrestrial situations but challenges remain as constraints of space flights and habitation impose severe limitations of these technologies. Membrane-based technologies, particularly membrane filtration, have been widely studied by NASA and NASA-funded research groups for possible applications in space wastewater treatment. The advantages of membrane filtration are apparent: it is energy-efficient and compact, needs little consumable other than replacement membranes and cleaning agents, and doesn't involve multiphase flow, which is big plus for operations under microgravity environment. However, membrane lifespan and performance are affected by the phenomena of concentration polarization and membrane fouling. This article attempts to survey current status of membrane technologies related to wastewater treatment and desalination in the context of space exploration and quantify them in terms of readiness level for space exploration. This paper also makes specific recommendations and predictions on how scientist and engineers involving designing, testing, and developing space-certified membrane-based advanced water recovery technologies can improve the likelihood of successful development of an effective regenerative human life support system for long-duration space missions.

Author

Space Exploration; Long Duration Space Flight; Water Reclamation; Waste Water; Life Support Systems; Water; Membranes; Filtration

20050202077 NASA Glenn Research Center, Cleveland, OH, USA

Interferometer-Controlled Optical Tweezers Constructed for Nanotechnology and Biotechnology

Decker, Arthur J.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A new method to control microparticles was developed in-house at the NASA Glenn Research Center in support of the nanotechnology project under NASA's Aerospace Propulsion and Power Base Research Program. A prototype interferometer-controlled optical tweezers was constructed to manipulate scanning probe microscope (SPM) tips. A laser beam passed through a Mach-Zehnder interferometer, and a microscope objective then produced an optical trap from the coaxial beams. The trap levitated and generated the coarse motion of a 10-mm polystyrene sphere used to simulate a SPM tip. The interference between the beams provided fine control of the forces and moments on the sphere. The interferometer included a piezoelectric-scanned mirror to modulate the interference pattern. The 10-mm sphere was observed to oscillate about 1 mm as the mirror and fringe pattern oscillated. The prototype tweezers proved the feasibility of constructing a more sophisticated interferometer tweezers to hold and manipulate SPM tips. The SPM tips are intended to interrogate and manipulate nanostructures. A more powerful laser will be used to generate multiple traps to hold nanostructures and SPM tips. The vibrating mirror in the interferometer will be replaced with a spatial light modulator. The modulator will allow the optical phase distribution in one leg of the interferometer to be programmed independently at 640 by 480 points for detailed control of the forces and moments. The interference patterns will be monitored to measure the motion of the SPM tips. Neuralnetwork technology will provide fast analysis of the interference patterns for diagnostic purposes and for local or remote feedback control of the tips. This effort also requires theoretical and modeling support in the form of scattering calculations for twin coherent beams from nonspherical particles.

Author

Interferometers; Nanotechnology; Nanostructures (Devices); Biotechnology; Diffraction Patterns; Feedback Control

20050202085 NASA Glenn Research Center, Cleveland, OH, USA

Fiber-Optic Pressure Sensor With Dynamic Demodulation Developed

Lekki, John D.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Researchers at the NASA Glenn Research Center developed in-house a method to detect pressure fluctuations using a fiber-optic sensor and dynamic signal processing. This work was in support of the Intelligent Systems Controls and Operations project under NASA's Information Technology Base Research Program. We constructed an optical pressure sensor by attaching a fiber-optic Bragg grating to a flexible membrane and then adhering the membrane to one end of a small cylinder. The other end of the cylinder was left open and exposed to pressure variations from a pulsed air jet. These pressure variations flexed the membrane, inducing a strain in the fiber-optic grating. This strain was read out optically with a dynamic

spectrometer to record changes in the wavelength of light reflected from the grating. The dynamic spectrometer was built in-house to detect very small wavelength shifts induced by the pressure fluctuations. The spectrometer is an unbalanced interferometer specifically designed for maximum sensitivity to wavelength shifts. An optimum pathlength difference, which was determined empirically, resulted in a 14-percent sensitivity improvement over theoretically predicted path-length differences. This difference is suspected to be from uncertainty about the spectral power difference of the signal reflected from the Bragg grating. The figure shows the output of the dynamic spectrometer as the sensor was exposed to a nominally 2-kPa peak-to-peak square-wave pressure fluctuation. Good tracking, sensitivity, and signal-to-noise ratios are evident even though the sensor was constructed as a proof-of-concept and was not optimized in any way. Therefore the fiber-optic Bragg grating, which is normally considered a good candidate as a strain or temperature sensor, also has been shown to be a good candidate for a dynamic pressure sensor.

Author

Fiber Optics; Pressure Sensors; Optical Measuring Instruments; Pressure Oscillations; Temperature Sensors; Interferometers; Signal Processing; Dynamic Pressure; Demodulation

20050203726 Swales Aerospace, USA

Evaluation of Particulate Generation from Disposable Cleanroom Garments

Joshi, Monali B.; LeVesque, Raymond J., II.; 23rd Space Simulation Conference Proceedings; [2005], pp. 1-15; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Disposable cleanroom garments offer a practical alternative to traditional cloth cleanroom garments due to their cost, availability, and convenience. Disposable garments are constructed from a variety of different materials, which provide differing particle filtration and particle generation properties. Several commercially available disposable garments were tested per two ASTM test methods for particulate contamination generation. The measured results were compared to those obtained from a standard 100% polyester cloth garment to evaluate the suitability of the disposable garments in a Class 10,000 cleanroom environment. The results of this testing are presented and discussed.

Author

Garments; Particulates; Disposal; Clean Rooms; Ground Crews

20050203917 Dani (Anil S.), Unknown

IWM: Internet and Water Management in the Middle-East (GCC countries), Technological Perspective

Dani, Anil S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 27 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Water is the most scarce resource in the Middle East. Creation of required water supply capabilities will be consuming billions of Dollars in the next ten years. This region is most active socio-politically for last several years. It is expected to remain so for the next decade. New water resources development technologies would play an important role in the life of a common person here. The Sustainable Water Management in the Middle-East needs involvement of all the stake holders i.e. Professionals, Government and Public. The Professionals and the Governments are seriously working on the problem. The Public interest depends largely on their understanding of the problem, which effectively can be achieved by using a novel solution 'Creating Internet Super Highway With Free-Drive Islands.'

Author

Water Management; Internets; Water Resources

20050203999 NASA Marshall Space Flight Center, Huntsville, AL, USA

In Situ Resource Utilization Technology Research and Facilities Supporting the NASA's Human Systems Research and Technology Life Support Program

Schlagheck, Ronald A.; Sibille, Laurent; Sacksteder, Kurt; Owens, Chuck; [2005]; 1 pp.; In English; Planetary and Terrestrial Mining Sciences Symposium, 5-8 Jun. 2005, Sudbury, Canada; No Copyright; Avail: Other Sources; Abstract Only

The NASA Microgravity Science program has transitioned research required in support of NASA's Vision for Space Exploration. Research disciplines including the Materials Science, Fluid Physics and Combustion Science are now being applied toward projects with application in the planetary utilization and transformation of space resources. The scientific and engineering competencies and infrastructure in these traditional fields developed at multiple NASA Centers and by external

research partners provide essential capabilities to support the agency's new exploration thrusts including In-Situ Resource Utilization (ISRU). Among the technologies essential to human space exploration, the production of life support consumables, especially oxygen and; radiation shielding; and the harvesting of potentially available water are realistically achieved for long-duration crewed missions only through the use of ISRU. Ongoing research in the physical sciences have produced a body of knowledge relevant to the extraction of oxygen from lunar and planetary regolith and associated reduction of metals and silicon for use meeting manufacturing and repair requirements. Activities being conducted and facilities used in support of various ISRU projects at the Glenn Research Center and Marshall Space Flight Center will be described. The presentation will inform the community of these new research capabilities, opportunities, and challenges to utilize their materials, fluids and combustion science expertise and capabilities to support the vision for space exploration.

Author

Combustion; Manufacturing; Physical Sciences; Radiation Shielding; Microgravity; Life Support Systems

59

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20050199683 Center for Information Systems Security Studies and Research, Monterey, CA, USA, Naval Postgraduate School, Monterey, CA, USA

Least Privilege Model for Static Separation Kernels

Levin, T. E.; Irvine, C. E.; Nguyen, T. D.; Oct. 2004; 26 pp.; In English

Report No.(s): PB2005-108602; NPS-CS-05-003; No Copyright; Avail: CASI; [A03](#), Hardcopy

We extend the separation kernel abstraction to represent the enforcement of the principle of least privilege. In addition to the inter-block flow control policy prescribed by the traditional separation kernel paradigm, we describe an orthogonal finer-grained flow control policy by extending the protection of elements to subjects and resources, as well as blocks, within a partitioned system. We show how least privilege applied to the actions of subjects and resources provides enhanced protection for secure systems, and how only 'trusted subjects' may cause certain information flows between partitions. A high assurance separation kernel based on least privilege can provide all of the functionality and protection of the traditional separation kernel, combined with a high level of confidence that the effects of subjects' activities can be minimized to their intended scope.

NTIS

Kernel Functions; Information Flow

20050199684 Center for Information Systems Security Studies and Research, Monterey, CA, USA

High Assurance Testbed for Multilevel Interoperability: 2004 Developments

Irvine, C. E.; Nguyen, T. D.; Levin, T. E.; Oct. 2004; 14 pp.; In English

Contract(s)/Grant(s): E338270; N0001403WX21224

Report No.(s): PB2005-108601; NPS-CS-05-002; No Copyright; Avail: CASI; [A03](#), Hardcopy

Current military and intelligence operations utilize a variety of specialized (often called 'stovepiped') systems to provide I/O and computing. Access to and controlled sharing of information from various networks operating at different classifications (e.g., NIPRNET, SIPRNET, JWICS, and COWANS) is difficult in ad hoc operational networks. To address the exchange of information in command and control and intelligence systems in the emerging Global Information Grid (GIG), such as the Theater Battle Management Core System (TBMCS), requires support for high assurance authentication and multilevel capabilities. These requirements provide the impetus for the creation of two complementary research efforts: the Monterey Security Architecture (MYSEA) project and the Trusted Computing Exemplar (TCX) project. The objective of the MYSEA project is to explore and develop a high assurance heterogeneous distributed operating environment that is capable of enforcing multilevel security policies while maintaining support for existing applications and unmodified commodity client systems. The purpose of the TCX project is to provide an openly distributed worked example of how high assurance trusted components could be constructed. The TCX reference implementation, i.e., the TCX Separation Kernel, will be developed in accordance with the Common Criteria evaluation methodology and will be used as the underlying trusted foundation for two MYSEA trusted components, the Trusted Path Extension (TPE) and Trusted Channel Module (TCM). Synergistically, the purpose of the Multilevel Security (MLS) Testbed project is to create a stable testing environment for experimentation in high assurance security services being developed in the MYSEA and TCX projects. These include assured authentication and

trusted path access to security critical functions, MLS services and secure single level connections to existing classified networks. The MLS Testbed project is an on-going effort supported by multiple sponsors. This document describes the progress made in FY2004 that includes the construction of the MLS Testbed and the functional testing of the security services currently supported by the MYSEA server.

NTIS

Computer Information Security; Microwave Landing Systems

20050199710 Helsinki Univ. of Technology, Helsinki, Finland

The Blagovescenskii Identity and the Inverse Scattering Problem

Bingham, Kenrick; Martio, Olli, Editor; 2005; ISSN 1239-6303; 91 pp.; In English

Report No.(s): Rept-142; Copyright; Avail: Other Sources

The inverse scattering problem for the plasma wave equation given in three space dimensions is considered in this thesis. It is shown that, under certain assumptions about the potential, the time domain scattering problem can be formulated equivalently in the frequency domain. Time and frequency domain techniques are combined in the subsequent analysis. The Blagovescenskii identity is generalised to the case of scattering data, assuming an inverse polynomial decay of the potential. This identity makes it possible to calculate the inner product of certain solutions of the plasma wave equation at a given time, if the corresponding incident waves and the scattering amplitude are known. In the case of a compactly supported potential, these inner products can be calculated for the time derivatives of all solutions. In the remaining part of the work, the potential is assumed to be compactly supported. A variant of the boundary control method is used to show that using appropriate superpositions of plane waves as incident waves, it is possible to excite a wave basis over a compact set. Letting this set shrink to a point, the Blagovescenskii identity provides pointwise information about the solutions. When substituted into the plasma wave equation, this yields a method for solving the inverse problem.

Author

Identities; Inverse Scattering; Wave Equations; Problem Solving

20050199734 Lawrence Livermore National Lab., Livermore, CA USA

Advantages of High Order Schemes and How to Confirm These Advantages

Nov. 26, 2001; 14 pp.; In English

Report No.(s): DE2005-15013364; UCRL-ID-146558; No Copyright; Avail: Department of Energy Information Bridge

This manuscript is meant to give a short summary of the advantages of high order schemes and suitable test problems which can properly illustrate these advantages.

NTIS

Partial Differential Equations; Grid Generation (Mathematics); Hyperbolic Functions

20050201821 California Univ., Santa Cruz, CA, USA

Verification and Validation of the RAGE Hydrocode in Preparation for Investigation of Impacts into a Volatile-rich Target

Plesko, C. S.; Asphaug, E.; Gisler, G. R.; Gittings, M. L.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 88-89; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Before a hydrocode is used to investigate a question of scientific interest, it should be tested against analogous laboratory experiments and problems with analytical solutions. The Radiation Adaptive Grid Eulerian (RAGE) hydrocode[1], developed by Los Alamos National Laboratory (LANL) and Science Applications International Corporation (SAIC)[2,3] has been subjected to many tests during its development.[4,5] We extend and review this work, emphasizing tests relevant to impact cratering into volatile-rich targets.

Derived from text

Computational Grids; Cratering; Targets; Hydrodynamics; Computer Programs

20050201935 Lawrence Livermore National Lab., Livermore, CA USA

Normalized Texture Motifs and Their Application to Statistical Object Modeling

Newsam, S. D.; Mar. 10, 2004; 12 pp.; In English

Report No.(s): DE2005-15013942; UCRL-CONF-202814; No Copyright; Avail: Department of Energy Information Bridge

A fundamental challenge in applying texture features to statistical object modeling is recognizing differently oriented spatial patterns. Rows of moored boats in remote sensed images of harbors should be consistently labeled regardless of the

orientation of the harbors, or of the boats within the harbors. This is not straightforward to do, however, when using anisotropic texture features to characterize the spatial patterns. We here propose an elegant solution, termed normalized texture motifs, that uses a parametric statistical model to characterize the patterns regardless of their orientation. The models are learned in an unsupervised fashion from arbitrarily orientated training samples. The proposed approach is general enough to be used with a large category of orientation-selective texture features.

NTIS

Mathematical Models; Statistical Analysis; Textures

20050201943 Swedish Defence Research Establishment, Stockholm, Sweden

Vaerdering av IT-Saakerhetsanalysmetoder inom Samhaellsviktig Infrastruktur (Assessment of IT Security Analysis Methods in Critical Infrastructure)

Christiansson, H.; Jun. 2004; 124 pp.; In Swedish

Report No.(s): PB2005-107455; FOI-R-1350-SE; No Copyright; Avail: CASI; [A06](#), Hardcopy

This report is concerned with the study of different activities related to the analysis of IT-systems in critical infrastructure from a security perspective. These kind of activities are relevant in the preventive security work. Relevant activities are for instance termed risk analysis, security analysis and vulnerability analysis. A set of methods are considered and assessed in relation to their importance to Swedish national IT security work within the Swedish critical infrastructure.

NTIS

Computer Information Security; Information Systems; Security

20050201948 Northeastern Research Station, Princeton, WV, USA

Rough Mill Improvement Guide for Managers and Supervisors

Mitchell, P. H.; Wiedenbeck, J.; Ammerman, B.; Jun. 2005; 74 pp.; In English

Report No.(s): PB2005-108504; FSGTR/NE-329; No Copyright; Avail: CASI; [A04](#), Hardcopy

Wood products manufacturers require an efficient recovery of product from lumber to remain profitable. A company's ability to obtain the best yield in lumber cut-up operations (i.e., the rough mill) varies according to the raw material, product, processing equipment, processing environment, and knowledge and skill of the rough mill's employees. This book discusses several key principles that can help manufacturers understand and solve yield and production problems. Our publication was inspired by the 1981 publication 'Rough Mill Operator's Guide' written by Edward K. Pepke and Michael J. Kroon. Computer-based technologies and new rough mill layouts and equipment are prevalent in today's rough mills, therefore, they are given considerable emphasis in this contemporary version of the Pepke-Kroon guide.

NTIS

Cutting; Forest Management; Industries; Procedures; Wood

20050201961 Lawrence Livermore National Lab., Livermore, CA USA

Autonomous Motion Segmentation of Multiple Objects in Low Resolution Video Using Variational Level Sets

Moelich, M.; Nov. 2003; 20 pp.; In English

Report No.(s): DE2005-15013642; UCRL-TR-201054; No Copyright; Avail: Department of Energy Information Bridge

This report documents research that was done during a ten week internship in the Sapphire research group at the Lawrence Livermore National Laboratory during the Summer of 2003. The goal of the study was to develop an algorithm that is capable of isolating (segmenting) moving objects in low resolution video sequences. This capability is currently being developed by the Sapphire research group as the first stage in a longer term video data mining project. This report gives a chronological account of what ideas were tried in developing the algorithm and what was learned from each attempt. The final version of the algorithm, which is described in detail, gives good results and is fast.

NTIS

Autonomy; Segments

20050202014 Texas Technological Univ., Lubbock, TX, USA

A Fundamental Mathematical Model of a Microbial Predenitrification System

Hoo, Karlene A.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 10-1 - 10-16; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Space flight beyond Low Earth Orbit requires sophisticated systems to support all aspects of the mission (life support,

real-time communications, etc.). A common concern that cuts across all these systems is the selection of information technology (IT) methodology, software and hardware architectures to provide robust monitoring, diagnosis, and control support. Another dimension of the problem space is that different systems must be integrated seamlessly so that communication speed and data handling appear as a continuum (un-interrupted). One such team investigating this problem is the Advanced Integration Matrix (AIM) team whose role is to define the critical requirements expected of software and hardware to support an integrated approach to the command and control of Advanced Life Support (ALS) for future long-duration human space missions, including permanent human presence on the Moon and Mars. A goal of the AIM team is to set the foundation for testing criteria that will assist in specifying tasks, control schemes and test scenarios to validate and verify systems capabilities. This project is to contribute to the goals of the AIM team by assisting with controls planning for ALS. Control for ALS is an enormous problem it involves air revitalization, water recovery, food production, solids processing and crew. In more general terms, these systems can be characterized as involving both continuous and discrete processes, dynamic interactions among the sub-systems, nonlinear behavior due to the complex operations, and a large number of multivariable interactions due to the dimension of the state space. It is imperative that a baseline approach from which to measure performance is established especially when the expectation for the control system is complete autonomous control.

Author

Life Support Systems; Information Systems; Computer Programs; Long Duration Space Flight; Numerical Integration; Real Time Operation

20050203919 Edith Cowan Univ., Mount Lawley, Australia

Global Optimisation for Optical Coating Design

Li, Dong-Guang; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 11 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The optimisation algorithms are playing a significant role in the field of the optical coating design. Many advanced local and global optimisation techniques, such as Gradient, Simplex, Flip-flop, Needle, Genetic and Simulated annealing, have been successfully applied to optical coating design. Any optimisation algorithm applied to a particular design problem should firstly address the issue of choosing a reasonable starting design, which is always a big obstacle to an inexperienced designer. To find the true global optimised solution for a coating design problem, we need to solve an array of interlinked multi-dimensional simultaneous equations. For more than just a few layers, until recently this has been a very difficult task, requiring the use of a supercomputer and highly skilled programming. By using the orthogonal Latin Square theory and an experimental design methodology in a search space reduction process, a Windows based program has been written that can operate on even a desktop personal computer. It can find the global optimum design for a 23 layers design using any dispersive and lossy material within a period of several hours. Additionally, this methodology (DGL-Optimisation, DGL is the short for D.G. Li) allows the use of target spectra such as s & p polarisation, with reflection and transmission simultaneously.

Author

Optical Materials; Coatings; Optimization; Algorithms; Design Analysis; Simultaneous Equations

20050203920 Edith Cowan Univ., Mount Lawley, Australia

Firearm Identification System Based on Ballistics Projectile Images

Li, Dong-Guang; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 12 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Characteristic markings on the cartridge case and projectile of a fired bullet are created when it is fired. Over thirty different features within these marks can be distinguished, which in combination produce a 'fingerprint' for a firearm. By analyzing features within such a set of firearm fingerprints, it will be possible to identify not only the type and model of a firearm, but also each every individual weapon as effectively as human fingerprint identification. A new analytic system based on fast Fourier transform (FFT) for identifying the projectile specimens by the line-scan imaging technique is proposed in this paper. Experimental results show that the proposed system can be used for firearm identification efficiently and precisely through digitizing and analyzing the fired projectiles specimens.

Author

Ballistics; Projectiles; Imaging Techniques; Identifying

20050203940 Air Force Inst. of Tech., OH, USA

Web Advertising Must Mature with Its Target Audience

Reisner, John; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although early predictions claimed internet advertising had great potential, initial euphoria was later supplanted by much cynicism and doubt. Some have suggested that recent misgivings indicate future trouble for companies seeking market penetration through internet advertising. However, internet advertisers should correct faulty assumptions about user behavior and reexamine how internet advertising investments are evaluated before abandoning this growing marketplace. Internet advertising can be worthwhile, but its benefits must be measured using reasonable expectations and assumptions. The so-called failure of internet advertising actually reflects faulty and overly-optimistic assumptions and expectations. By examining these faults, adjusting expectations, and redesigning the advertising model, the internet can indeed be an effective advertising medium.

Author

World Wide Web; Internets; Marketing

20050203945 Edith Cowan Univ., Mount Lawley, Australia

MS Windows Based Optical Thin-film Design Software with DGL Global Optimization

Li, Dong-Guang; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The paper describes an innovative global optimization algorithm and commercialized optical thin film design software using the discussed algorithm. The MS Windows software application has been developed, which shows a great advantage in finding a best optical thin film optimization design over other conventional design methods. One real world design problem is discussed in details.

Author

Thin Films; Optimization; Design Analysis; Algorithms; Optical Materials

20050203946 Houston Univ., TX, USA

Statistics Education Online: Challenges and Solutions

Hodges, Erin; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Statistics education presents special challenges using distance education. The development of a fully online business statistics course is described, with emphasis on tools such as website tutorials and graphics generation. Evidence on the effectiveness of the online course is presented via analysis of course grades. As an extension to the online course, an experimental procedure for generating multiple choice questions for an online test bank is discussed.

Author

Education; Commerce; Websites

20050203947 Warsaw Univ., Warsaw, Poland

Minimal Realization Problem for Positive Multivariable Linear Systems with Delay

Kaczorek, Tadeusz; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The realization problem for positive multivariable discrete-time systems with one time-delay is formulated and solved. Conditions for the solvability of the realization problem are established. A procedure for computation of a minimal positive

realization of a proper rational matrix is presented and illustrated by an example.

Author

Linear Systems; Matrices (Mathematics); Time Lag

20050203948 Catholic Univ. of Korea, Korea, Republic of

Application of Web-Based Electronic System to Diabetes Management

Cho, Jae-Hyoung; Kwon, Hyuk-Sang; Kim, Hee-Seung; Yoon, Kun-Ho; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Considering the recent dramatic increase in the number of patients and the medical cost, development of cost-efficient treatment modality for diabetic patients is urgent need. So, we developed a web-based electronic glucose monitoring system using internet as one of e-medicine system. With this system, we could show significant improvement of glycemic control by randomized controlled trial and most participants were satisfied with this system. Here we propose a framework to establish electronic medicine system for chronic disease management. This system could become much larger and more brisk with connection to mobile service system and with development of automatic data analysis system.

Author

Glucose; Metabolic Diseases; Data Processing; Patients; Diabetes Mellitus

20050203950 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Strategy for Improving US Middle School Student Mathematics Word Problem Solving Performance

Thomas, Valerie L.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

U.S. middle school students have difficulty understanding and solving mathematics word problems. Their mathematics performance on the Third International Mathematics and Science Study (TIMSS) is far below their international peers, and minority students are less likely than high socioeconomic status (SES) White/Asian students to be exposed to higher-level mathematics concepts. Research literature also indicates that when students use both In-School and Out-of-School knowledge and experiences to create authentic mathematics word problems, student achievement improves. This researcher developed a Strategy for improving mathematics problem solving performance and a Professional Development Model (PDM) to effectively implement the Strategy.

Author

Problem Solving; Schools; Mathematics; United States; Education

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20050200929 Naval Postgraduate School, Monterey, CA USA

Design of a Prototype Autonomous Amphibious WHEGS(Trademark) Robot for Surf-Zone Operations

Ward, Jason L.; Jun. 2005; 105 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435581; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Small Robot Initiative at the Naval Postgraduate School (NPS) has spent several years in development based on the Foster Miller lemmings platform. This platform, in conjunction with a commercial-off-the-shelf (COTS) control architecture, is capable of autonomous, land based waypoint navigation, self orientation, and rudimentary obstacle avoidance. It can receive waypoint information, manual control input, and transmit video and audio information back to a control station via 802.11 wireless communication. The introduction of the WHEGSTM design, developed at Case Western Reserve University, and a modified version of the COTS control system will provide a platform with greater speed, mobility and versatility. This thesis developed a prototype WHEGSTM vehicle and integrated the control system with improvements in the navigation routine through the addition of a dead reckoning sensor and calculation function. Although the mechanical design proved to be highly inefficient and unable to propel itself, the control system was successful, allowing integration with a more robust mechanical

design from Case Western Reserve University. Follow on development and research will lighten the body through the use of carbon fiber and test the robots ability to maneuver effectively in the surf-zone.

DTIC

Autonomy; Commercial Off-the-Shelf Products; Control; Prototypes; Robots

20050200966 Naval Postgraduate School, Monterey, CA USA

Photonic Analog-to-Digital Conversion Using a Robust Symmetrical Number System

Fisher, Adam S.; Jun. 2005; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435657; No Copyright; Avail: Defense Technical Information Center (DTIC)

A photonic analog-to-digital converter (ADC) based on a robust symmetrical number system (RSNS) was constructed and tested. The analog signal to be converted is used to amplitude modulate an optical pulse from a laser using three Mach-Zehnder interferometers (MZI). The Mach-Zehnder interferometers fold the input analog signal for a three-channel RSNS encoding. The folding waveforms are then detected and amplitude-analyzed by three separate comparator banks, the outputs of which are used to determine a digital representation of the analog signal. This design uses the RSNS preprocessing to encode the signal with the fewest number of comparators for any selected bit resolution. In addition to the efficiency of its use of comparators, the RSNS encoding has inherent Gray-code properties making it particularly attractive for eliminating any possible encoding errors. The RSNS encoding is combined with an optical infrastructure that offers high bandwidth and low insertion loss characteristics. A full implementation was constructed and tested. The lack of a high-speed data acquisition device limited the results to examining the preprocessing and digital processing separately. With the system integration of a data acquisition device, a wideband direct digital antenna architecture can be demonstrated.

DTIC

Analog to Digital Converters; Bandwidth; Symmetry

20050201730 Massachusetts Inst. of Tech., Westford, MA, USA

Haystack Observatory VLBI Correlator

Titus, Mike; Cappallo, Roger; Corey, Brian; Niell, Arthur; Whitney, Alan; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 151-153; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report presents the status of the Haystack Correlator. focusing on the activities, current and future hardware capabilities, and staff.

Author

Correlators; Observatories; Very Long Base Interferometry

20050201735 Academy of Sciences (Russia), Saint Petersburg, Russia

IAA Correlator Center

Surkis, Igor; Rusinov, Yuriy; Shantir, Violetta; Zimovsky, Vladimir; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 154-157; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Development of the new correlator MicroPARSEC was continued in 2004. Some experiments were carried out on the single unit MicroPARSEC. The development of the new correlator was continued. This correlator will be based on many MicroPARSEC devices. The old correlator TISS-1M was maintained.

Author

Correlators; Bandwidth; Computer Programs; Spectrum Analysis

20050201771 Technical Univ., Madrid, Spain

Issues in Wireless Security Based on AES Hardware Implementation

Bojanic, Slobodan; Carreras, Carlos; Diez, Juan M.; Nieto-Taladriz, Octavio; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 6-10; In English; See also 20050201770

Contract(s)/Grant(s): TIC2003-09061-C06-02; Copyright; Avail: CASI; [A01](#), Hardcopy

While short-term IEEE 802.11 wireless security solution (TKIP) accommodates existing hardware, the long-term security solution called CCMP is targeted at new hardware designs. This paper is related to FPGA/ASIC hardware architectural options in implementation of required AES crypto algorithm. We are addressing different design criteria like high-speed, low-cost, or

modes of operation like CCM. These issues are also of interest for wireless sensor networks whose secure low-power operations are referred by another IEEE standard (802.15.4).

Author

Algorithms; Hardware; Wireless Communication; Cryptography

20050203881 NASA Glenn Research Center, Cleveland, OH, USA

Higher-Order Theory: Structural/MicroAnalysis Code (HOTSMAC) Developed

Arnold, Steven M.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The full utilization of advanced materials (be they composite or functionally graded materials) in lightweight aerospace components requires the availability of accurate analysis, design, and life-prediction tools that enable the assessment of component and material performance and reliability. Recently, a new commercially available software product called HOTSMAC (Higher-Order Theory--Structural/MicroAnalysis Code) was jointly developed by Collier Research Corporation, Engineered Materials Concepts LLC, and the NASA Glenn Research Center under funding provided by Glenn's Commercial Technology Office. The analytical framework for HOTSMAC is based on almost a decade of research into the coupled micromacrostructural analysis of heterogeneous materials. Consequently, HOTSMAC offers a comprehensive approach for analyzing/designing the response of components with various microstructural details, including certain advantages not always available in standard displacement-based finite element analysis techniques. The capabilities of HOTSMAC include combined thermal and mechanical analysis, time-independent and time-dependent material behavior, and internal boundary cells (e.g., those that can be used to represent internal cooling passages, see the preceding figure) to name a few. In HOTSMAC problems, materials can be randomly distributed and/or functionally graded (as shown in the figure, wherein the inclusions are distributed linearly), or broken down by strata, such as in the case of thermal barrier coatings or composite laminates.

Derived from text

Composite Materials; Thermal Control Coatings; Thermal Analysis; Microanalysis; Functionally Gradient Materials

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20050199459 NASA Glenn Research Center, Cleveland, OH, USA

Virtual Reality Used to Serve the Glenn Engineering Community

Carney, Dorothy V.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

There are a variety of innovative new visualization tools available to scientists and engineers for the display and analysis of their models. At the NASA Glenn Research Center, we have an ImmersaDesk, a large, single-panel, semi-immersive display device. This versatile unit can interactively display three-dimensional images in visual stereo. Our challenge is to make this virtual reality platform accessible and useful to researchers. An example of a successful application of this computer technology is the display of blade out simulations. NASA Glenn structural dynamicists, Dr. Kelly Carney and Dr. Charles Lawrence, funded by the Ultra Safe Propulsion Project under Base R&T, are researching blade outs, when turbine engines lose a fan blade during operation. Key objectives of this research include minimizing danger to the aircraft via effective blade containment, predicting destructive loads due to the imbalance following a blade loss, and identifying safe, cost-effective designs and materials for future engines.

Derived from text

Computer Systems Design; Display Devices; Virtual Reality; Turbine Engines

20050199470 NASA Glenn Research Center, Cleveland, OH, USA

Computer Model Used to Help Customize Medicine

Stauber, Laurel J.; Veris, Jenise; Research and Technology 2000; March 2001; 1 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Dr. Radhakrishnan, a researcher at the NASA Glenn Research Center, in collaboration with biomedical researchers at the Case Western Reserve University School of Medicine and Rainbow Babies and Children's Hospital, is developing computational models of human physiology that quantitate metabolism and its regulation, in both healthy and pathological

states. These models can help predict the effects of stresses or interventions, such as drug therapies, and contribute to the development of customized medicine. Customized medical treatment protocols can give more comprehensive evaluations and lead to more specific and effective treatments for patients, reducing treatment time and cost. Commercial applications of this research may help the pharmaceutical industry identify therapeutic needs and predict drug-drug interactions. Researchers will be able to study human metabolic reactions to particular treatments while in different environments as well as establish more definite blood metabolite concentration ranges in normal and pathological states. These computational models may help NASA provide the background for developing strategies to monitor and safeguard the health of astronauts and civilians in space stations and colonies. They may also help to develop countermeasures that ameliorate the effects of both acute and chronic space exposure.

Author

Computerized Simulation; Chemotherapy; Human Reactions; Mathematical Models; Metabolism; Protocol (Computers)

20050199653 Boeing Co., USA

SQL-RAMS

Alfaro, Victor O.; Casey, Nancy J.; [2005]; 2 pp.; In English

Contract(s)/Grant(s): SSC-00207-1; NAS13-02014

Report No.(s): NASA/NP-2005-06-00053-SSC; No Copyright; Avail: Other Sources; Abstract Only

SQL-RAMS (where 'SQL' signifies Structured Query Language and 'RAMS' signifies Rocketdyne Automated Management System) is a successor to the legacy version of RAMS a computer program used to manage all work, nonconformance, corrective action, and configuration management on rocket engines and ground support equipment at Stennis Space Center. The legacy version resided in the FileMaker Pro software system and was constructed in modules that could act as stand-alone programs. There was little or no integration among modules. Because of limitations on file-management capabilities in FileMaker Pro, and because of difficulty of integration of FileMaker Pro with other software systems for exchange of data using such industry standards as SQL, the legacy version of RAMS proved to be limited, and working to circumvent its limitations too time-consuming. In contrast, SQL-RAMS is an integrated SQL-server-based program that supports all data-exchange software industry standards. Whereas in the legacy version, it was necessary to access individual modules to gain insight to a particular work-status documents, SQL-RAMS provides access through a single-screen presentation of core modules. In addition, SQL-RAMS enable rapid and efficient filtering of displayed statuses by predefined categories and test numbers. SQL-RAMS is rich in functionality and encompasses significant improvements over the legacy system. It provides users the ability to perform many tasks which in the past required administrator intervention. Additionally many of the design limitations have been corrected allowing for a robust application that is user centric.

Author

Query Languages; Rocket Engines; Computer Programs; Configuration Management; Software Engineering; Automatic Control

20050199669 NASA Glenn Research Center, Cleveland, OH, USA

Shuttle Payload Ground Command and Control: An Experiment Implementation Combustion Module-2 Software Development, STS-107

Carek, David Andrew; [2003]; 26 pp.; In English; Space Internet Workshop 3, 4 Jun. 2003, Cleveland, OH, USA

Contract(s)/Grant(s): WBS 22-337-41-06-C1; No Copyright; Avail: CASI; [A03](#), Hardcopy

This presentation covers the design of a command and control architecture developed by the author for the Combustion Module-2 microgravity experiment, which flew aboard the STS-107 Shuttle mission. The design was implemented to satisfy a hybrid network that utilized TCP/IP for both the onboard segment and ground segment, with an intermediary unreliable transport for the space to ground segment. With the infusion of Internet networking technologies into Space Shuttle, Space Station, and spacecraft avionics systems, comes the need for robust methodologies for ground command and control. Considerations of high bit error links, and unreliable transport over intermittent links must be considered in such systems. Internet protocols applied to these systems, coupled with the appropriate application layer protections, can provide adequate communication architectures for command and control. However, there are inherent limitations and additional complexities added by the use of Internet protocols that must be considered during the design. This presentation will discuss the rationale for the: framework and protocol algorithms developed by the author. A summary of design considerations, implantation issues, and learned lessons will be presented. A summary of mission results using this communications architecture will be presented. Additionally, areas of further needed investigation will be identified.

Author

Space Shuttle Payloads; Ground Based Control; Command and Control; Protocol (Computers); Internets; Space Shuttle Missions; Software Engineering; Payload Control; Avionics

20050200814 Odyssey Research Associates, Inc., Ithaca, NY USA

A Programming Logic for Distributed Systems

Bickford, Mark; Guaspari, David; Jun. 2005; 82 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0106

Report No.(s): AD-A435291; TR05-0007; AFRL-SR-AR-TR-05-0253; No Copyright; Avail: CASI; [A05](#), Hardcopy

ATC-NY and Cornell University are developing SCoRES, a mathematically based tool to support the development of demonstrably correct distributed Systems. SCoRES extends to distributed and hybrid systems a paradigm for program development that has been successful in the world of sequential programming-employing methods that are declarative (rather than operational) and constructive. Declarative methods permit systems to be specified, analyzed, developed, and verified at a conceptual level congenial to human designers. Constructive methods permit automatic code synthesis. Incorporating these methods within the NuPrl environment provides powerful automated support for specifying, developing, verifying, and synthesizing real-time distributed systems at a high level of abstraction. This report describes two things: a prototype that supports automatic code generation from proofs in a domain-specific logic of distributed systems (one that does not model real-time); an extension of that logic to the domain of hybrid systems, which may contain variables that vary continuously in real time. We demonstrate the code generator by deriving a verifiably correct leader election protocol; and we demonstrate the logic of hybrid systems by applying it to a mutual exclusion algorithm that generalizes Fischer's protocol to distributed systems.

DTIC

Coding; Computer Programming; Mathematical Models

20050200831 Air Force Research Lab., Edwards AFB, CA USA

COLISEUM: An Application Programming Interface for 3D Plasma Simulations

VanGilder, Douglas; Dec. 2004; 19 pp.; In English

Contract(s)/Grant(s): Proj-4847

Report No.(s): AD-A435314; AFRL-PR-ED-VG-2004-363; No Copyright; Avail: CASI; [A03](#), Hardcopy

APPROACH: A new 3D plasma simulation system (COLISEUM) is being developed: * Allows easy implementation of various plasma simulation modules for quicker code development & controllable fidelity * Using COTS extensively. CURRENT STATUS: * Low-fidelity plume (prescribed plume & ray tracing) * High-fidelity plume (AQUILA & DRACO) * Thruster modeling (HET & Colloid). FUTURE WORK: * DRACO (charging, sputtering, surface contamination) * AQUILA (parallel, generalized collisions) * Device modeling (HET extension) * Plasma diagnostics.

DTIC

Application Programming Interface; Exhaust Gases; Plasmas (Physics); Plumes; Simulation

20050200832 Naval Postgraduate School, Monterey, CA USA

Expressing an Information Security Policy Within A Security Simulation Game

Irvine, Cynthia E.; Thompson, Michael F.; Jul. 2004; 8 pp.; In English

Report No.(s): AD-A435316; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Center for the Information Systems Studies and Research (CISR) at the Naval Postgraduate School has established a broad program in computer and network security education. The program, founded on a core in traditional computer science, is extended by a progression of specialized courses and a broad set of information assurance research projects. A CISR objective has been improvement of information assurance education and training for the U.S. military and government. Pursuant to that objective, CISR is developing a computer simulation game, CyberCIEGE, to teach computer security principles. CyberCIEGE players construct computer networks and make choices affecting the ability of these networks and the game's virtual users to protect valuable assets from attack by both vandals and well-motivated professionals. CyberCIEGE includes a language for expressing different security related scenarios. A central part of this language is an ability to express a variety of different information security policies.

DTIC

Computer Information Security; Computer Networks; Policies; Security; Simulation

20050200833 Naval Postgraduate School, Monterey, CA USA

The Bastion Network Project: A Framework for Conducting Interscholastic Cyber-Exercises

Fulp, J. D.; Jul. 2004; 8 pp.; In English

Report No.(s): AD-A435318; No Copyright; Avail: CASI; [A02](#), Hardcopy

The Naval Postgraduate School's Center for Information Systems Security Studies and Research (CISR) has developed a small, but realistic network lab-the Bastion Network- that is dedicated to educating students in the myriad elements involved in the secure operation of a computer network. This paper describes the rationale for this network lab, and offers an overview of a simple framework that could accommodate educational network interaction with other schools that have similar IA educational goals, and that have, or may soon acquire, similarly designated labs. The framework describes the essential elements of a memorandum of understanding, and twelve suggested inter-network cyber-exercise scenarios.

DTIC

Computer Networks; Security

20050200854 Skiametrics, Inc., Winchester, MA USA

X-Ray MegaVolt Digital Imaging Inspection System

Burstein, Paul; Youngberg, Jim; Jul. 2005; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W15QKN-05-C-1182

Report No.(s): AD-A435412; PICA-1182F; No Copyright; Avail: Defense Technical Information Center (DTIC)

'Report developed under SBIR contract for topic A04-022.' The X-ray Imaging Module (XIM) is a compact, efficient, inexpensive imager component that can be ganged with other XIMs to produce very high spatial resolution seamless images over very large areas, over 2 meters in a single dimension, if necessary. XIM provides fast, deep-dynamic range, low-noise calibrated digital readouts at a user- selectable/motion- coordinated rate, enabling virtually all reconstructive imaging applications, such as CT, TDI, and laminography at energies of 2 MeV. In phase I, we built and tested a single prototype XIM unit at 2 MeV using the high energy x-ray source available at the Picatinny Arsenal. We proved a stitching approach that allows the construction of a single seamless very large image from multiple, smaller, slightly-overlapping images. We provided a multi-XIM unit that can image a region as large as 12 x 48 or 20 x 24 inches at high spatial resolution. A one-dimensional grid scatter- rejection scheme that will eventually reduce scattering at high energies was tested. In phase II, Skiametrics will build provide an erector-set multi-configuration 4-XIM unit, allowing very large areas, e.g., 12 x 48 inches or 20 x 24 inches, to be imaged at very high spatial resolution.

DTIC

Digital Systems; Images; Inspection; X Ray Imagery

20050200857 Georgia Tech Research Inst., Atlanta, GA USA

I/O-Intensive Embedded Systems: The Infopipe Approach

Pu, Carlton; Eisenhauer, Greg; Ahamad, Mustaque; Yan, Wenchang; Liu, Ling; Walpole, Jonathan; Schwan, Karsten; Jul. 2004; 63 pp.; In English

Contract(s)/Grant(s): F33615-00-C-3049; Proj-A041

Report No.(s): AD-A435430; AFRL-VA-WP-TR-2005-3057; No Copyright; Avail: Defense Technical Information Center (DTIC)

Infopipes are a distributed computational and communications abstraction for information flow applications and I/O intensive distributed real-time embedded (DRE) systems. Infopipes are specified by the syntax, semantics, and quality of service requirements for information flows. Software tools generate executable code from the specification. Building applications that process information flows on existing middleware platforms is difficult, because of the variety of QoS requirements, the need for application-specific protocols, and the poor match of the commonly used abstraction of remote invocations to streaming. The ability to query individual Infopipe elements as well as composite Infopipes for properties of supported flows enables QoS-aware configuration. Similar to local protocol frameworks, Infopipes provide a flexible infrastructure for configuring communication services from modules, but unlike protocols the abstraction uniformly includes the entire pipeline from source to sink, possibly across process and node boundaries.

DTIC

Embedding; Real Time Operation; Software Development Tools; Telecommunication

20050200884 Kestrel Inst., Palo Alto, CA USA

FORGES: Formal Synthesis of Generators for Embedded Systems

Errington, Lindsay; May 2005; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0155; Proj-MOBI

Report No.(s): AD-A435496; AFRL-IF-RS-TR-2005-196; No Copyright; Avail: Defense Technical Information Center (DTIC)

A number of tools exist that allow engineers to construct models of embedded systems. Models are expressed in a variety of languages including domain specific languages. These models provide input to generators that: 1) produce code, test suites, views of components in the model, and/or 2) analyze or compose models. Generators, however, are often difficult and expensive to develop. Moreover, due to the safety critical nature of embedded systems, it is crucial that generators be high assurance. This project has developed technology for the automated synthesis of model-based generators from language meta-models. Using partial evaluation, Kestrel has demonstrated the synthesis of generators that are provably correct, and that can be produced and modified with drastically less time and effort compared with manual production. The success of the project can be traced to two major contributions. The first, a technology breakthrough, is a new tractable formulation of partial evaluation. The second is a collection of meta-models that serve as comprehensive definitions of the semantics of widely-used commercial modeling languages.

DTIC

C (Programming Language); Coding; Embedding; Signal Processing

20050200885 Texas A&M Univ., College Station, TX USA

Quantum Optical Implementations of Current Quantum Computing Paradigms

Scully, Marlan O.; Zubairy, M. S.; Welch, George R.; May 2005; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-1-0594; Proj-558B

Report No.(s): AD-A435497; AFRL-IF-RS-TR-2005-204; No Copyright; Avail: Defense Technical Information Center (DTIC)

We have taken a systematic study of the use of the tools of quantum optics for the implementation of tasks relevant to quantum information and computing. As is widely recognized, the maturation of the field may lead to dramatic improvements in current abilities to process data, communicate securely, and simulate natural processes. Applications range from decoding cryptographic codes and secure key distribution to reducing the complexity of computational problems such as database search and pattern recognition. The key tools we use to accomplish quantum information tasks are coherence in atomic and photonic systems, and the entanglement between correlated subsystems, both of which have been extensively studied in this report.

DTIC

Quantum Computation; Quantum Optics

20050200900 Naval Postgraduate School, Monterey, CA USA

Automatic Test Case Generation for Reactive Software Systems Based on Environment Models

Imanian, James A.; Jun. 2005; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435526; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of software testing is to expose as many faults as possible. Often one can increase the number of faults detected by running large amounts of test cases, therefore the ability to automatically generate applicable test cases for a System Under Test (SUT), would be a valuable tool. In this thesis an attributed event grammar is designed and used to build a model that describes the environment a SUT must operate in. This event grammar captures events, their precedence or inclusion relation to other events, and attributes of the events. An event is defined as an observable action that has a distinct beginning and end. The high level environment model is then used by a test generator to produce an event trace from which input for the SUT is extracted. Thousands of event traces can be generated. For reactive systems the event trace will have the appropriate time delays between inputs. The feasibility of this approach is proven by implementing a prototype of an automated test generator based on environment models.

DTIC

Computer Programming; Environment Models; Evaluation; Program Verification (Computers); Reactivity; Software Engineering; System Effectiveness

20050200911 Naval Postgraduate School, Monterey, CA USA

Modeling the Use of the AJCN in a Tactical Environment

Watts, Krista; Jun. 2005; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435555; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Adaptive Joint Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Node (AJCN) is a new C4ISR system with four functional capabilities: communications, signal intelligence (SIGINT), electronic warfare (EW) and Information Operations. This thesis evaluates the first three capabilities of the AJCN: communications, SIGINT and EW. Simulation is used as a time- and cost-effective way to model the AJCN's capabilities.

Eleven communications and combat effectiveness MOE are used to evaluate the AJCN's performance. Point of Attack 2, a tactical simulation with an extensive database is used to replicate the AJCN and UA operations. Results of the analysis include: 1) the AJCN significantly increased friendly detection of enemy forces; 2) the AJCN significantly decreased average message transmittal time and the number of failed messages; 3) the AJCN increased the friendly force's capability to jam and intercept enemy messages.

DTIC

Command and Control; Intelligence

20050200923 Naval Postgraduate School, Monterey, CA USA

Role-Based Access Control for Coalition Partners in Maritime Domain Awareness

McDaniel, Christopher R.; Tardy, Matthew L.; Jun. 2005; 108 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435572; No Copyright; Avail: Defense Technical Information Center (DTIC)

The need for Shared Situational Awareness (SSA) in accomplishing joint missions by coalition militaries, law enforcement, the intelligence community, and the private sector creates a unique challenge to providing access control. In this thesis we investigate the capabilities and limitations of Role-Based Access Control (RBAC) to control the dissemination of SSA in a coalition environment. Our case study is that of controlling access to SSA in the Maritime Domain Awareness (MDA) environment. MDA exemplifies both rapid change in membership of coalitions and the roles of coalition participants. We explore the access policy and roles played by the participants in the MDA environment, in addition to the characteristics of those roles. We make use of feasible scenarios to provide us with a base for applying models to the situation. The models that are applied to the scenario provide the formal methods that prove that RBAC policies and derivatives such as Distributed Role Based Access Control (DRBAC), Coalition Based Access Control (CBAC) and Temporal Role Based Access Control (TRBAC) can be used in conjunction with the Information Broker (TB) concept to provide adequate access control policies.

DTIC

Access Control; Computer Information Security; Information Retrieval; Numerical Control

20050200939 Naval Postgraduate School, Monterey, CA USA

Auditory Detection and Sound Localization for Computer-Generated Individual Combatants

Michaud, John C.; Jun. 2005; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435615; No Copyright; Avail: Defense Technical Information Center (DTIC)

Soldiers rely predominantly on vision to detect targets yet other senses may cue their sense of sight. Contrarily most army combat simulations employ only visual cues. The focus of this thesis is to enhance combat simulations by providing a method by which computer-generated entities can detect and locate objects via a phenomenon known as 'sound localization.' The Auditory Detection Program is used to represent a human's hearing and data from a sound localization experiment are analyzed to determine how to best represent the event in which an individual hears a sound and then estimates the location of the sound's source. The resulting algorithms are coded into the Army's combat simulation COMBAT(XXI) and the face-validation method is used to determine if the algorithms enhance the realism of the simulation. The data analysis consists of Shapiro-Wilks Tests for Normality Friedman's Tests for Randomized Block Experiment, and Wilcoxon Rank-Sum Tests using the Bonferroni Correction. Implementing this model in COMBAT(XXI) improves the simulation by making it more realistic.

DTIC

Acuity; Auditory Perception; Combat; Detection; Military Personnel; Position (Location); Simulation; Sound Localization; Target Acquisition

20050200959 Naval Postgraduate School, Monterey, CA USA

Modeling Sound as a Non-Lethal Weapon in the COMBAT(XXI) Simulation Model

Grimes, Joseph D.; Jun. 2005; 61 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435642; No Copyright; Avail: Defense Technical Information Center (DTIC)

Modeling and representing combat and individual soldiers is a complex task. Several factors influence combatant behavior. Using non-lethal methods has become one way for combatant commanders to accomplish their wartime mission. Current the Army and Marine Corps models are not capable of non-lethal weapon replication. The U.S. Army Training and Doctrine Command Analysis Center (TRAC) Monterey California has funded a program of research related to individual combatant representation in modeling and simulation. Modeling non-lethal weapons was identified by TRAC-Monterey as important to better represent actual combat. This thesis use COMBAT(XXI), a high-resolution, closed-form, stochastic,

analytical combat simulation, to replicate non-lethals and study the effects on individual combatants. Existing source code was modified to model the Long Range Acoustic Device (LRAD), the non-lethal platform chosen for this research. LRAD is an acoustic device designed to modify the behavior of personnel with a high intensity warning tone. Once the LRAD capability was developed, a scenario was developed to test the simulated effects of the device. A model was developed to accurately determine behaviors of individual combatants. It was concluded that the implementation of this new non-lethal capability in COMBAT(XXI) improved the model and created a more realistic representation of actual combat.

DTIC

Combat; Simulation

20050200969 Naval Postgraduate School, Monterey, CA USA

Deployable Network Operations Center (DNOC): A Collaborative Technology Infostructure Designed to Support Tactical Sensor-Decision Maker Network Operations

Johnson, Shawn E.; Jun. 2005; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435660; No Copyright; Avail: Defense Technical Information Center (DTIC)

The coordination and collaboration of information has never before been more important to the success of tactical missions. Hybrid wireless-mesh networks have the capability to put critical information at the fingertips of the operator, enabling tactical units to successfully carry out their missions. The increasing use of expeditionary and special operations forces operating in ad hoc, dynamic, and tactical environments poses a need for an adaptable, flexible, and responsive Deployable Network Operations Center (DNOC) to support their efforts. Whether co-located or virtual, the DNOC must supply tactical units with the right information, at the right time, and in the right format. The DNOC must also serve as a rapid, reliable, and secure communications network platform so that forces can collaborate in a manner which builds quality interactions and trust. This thesis effort consisted of designing, building, and implementing a DNOC to support Naval Postgraduate School's Tactical Sensor-Decision Making Network (TSDN) field experiments. Baseline operating processes were explored and recommendations for life-cycle maintenance and future upgrades are made.

DTIC

Communication Networks; Decision Making; Military Personnel; Warfare

20050201014 Air Force Research Lab., Mesa, AZ USA

USAF Security Forces Training Needs

Weeks, Joseph L.; Garza, Jorge S.; Archuleta, Mark A.; McDonald, L. B.; Sep. 2002; 17 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924

Report No.(s): AD-A435744; AFRL-HE-AZ-TP-2002-0001; AFRL-HE-AZ-TP-2002-0001; No Copyright; Avail: Defense Technical Information Center (DTIC)

Security forces ensure the USA Air Force (USAF) combat capability by providing force protection. The Air Force Research Laboratory and McDonald Research Associates have launched a research and development project dedicated to exploring affordable strategies for security forces distributed mission training-known as SecForDMT. The current approach consists of the design, development, and evaluation of distributed interactive simulations. Expert assessments indicate the potential of this technology for support of instructional objectives involving command and control, decision making, and team coordination. To ensure emerging technology supports warfighter needs, technology assessments must be considered in combination with training requirements. The purpose of this paper is to review empirical data that describe training needs of security forces enlisted and officer personnel and to discuss implications for SecForDMT.

DTIC

Distributed Interactive Simulation; Education; Personnel; Security

20050201056 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA

Assessment of Human Interaction with Virtual Environment Training Technology

Ntuen, Celestine A.; Yoon, S.; Oct. 2002; 46 pp.; In English

Contract(s)/Grant(s): F41624-00-1-0001; Proj-1123

Report No.(s): AD-A435812; AFRL-HE-AZ-TR-2002-0207; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research investigated the evidence of performance improvement of piloting skills while using an immersive virtual environment (IVE) versus a nonimmersive virtual environment (NIVE) to train instrument pilot skills. The general hypothesis tested was whether there is equal improvement for people trained under IVE and NIVE. Subjects were tested in IVE and NIVE

flight scenarios using three flying tasks-normal crosswind approach and landing (NCAL), go-around (GA), and constant speed during climbing and descending (CSCD). Data were analyzed for two measures-errors and error rate, for four dependant variables: altitude control, heading control, airspeed control, and vertical airspeed control. Overall, results failed to demonstrate enhanced training effectiveness for an immersive VR training environment compared to a desktop (nonimmersive) environment. These results indicate that the cost tradeoff between the uses of IVE over NIVE are task dependent and influenced by the fidelity of training environments. The results obtained from the current experiment do justify some potential cost-saving advantage of IVE over NIVE on selected task. For example, NIVE seems to provide training advantages on error rate reduction on control of vertical airspeed and altitude under NCAL tasks. Similarly, IVE seems to offer training advantages of error rate reduction on airspeed control and heading control under NCAL, and heading and vertical airspeed controls under GA tasks. However, the fact that either IVE or NIVE provides an increase in piloting task performance in some tasks needs to be considered in any training investment decision.

DTIC

Education; Virtual Reality

20050201080 Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA

Automatic Detection of Steganographic Content

Jun. 2005; 31 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0110

Report No.(s): AD-A435865; AFRL-SR-AR-TR-05-0272; No Copyright; Avail: CASI; [A03](#), Hardcopy

In this document, we will describe our Anti-Steganography project for Phase 1. First, we will present the Software Architecture in Section 1. In Section 2, we will describe in details the Application Programming Interfaces (APIs) and the Software implementation. In Section 3, we will show the organization of the source code. Section 4 discusses how to maintain and extend the software. Section 5 discusses the automatic engine update service. A description of the Phase 1 demo is given in Section 6. Finally, we describe the steganography research activities and results in Section 7.

DTIC

Detection; Human-Computer Interface; Steganography

20050201093 Naval Postgraduate School, Monterey, CA USA

Simulation to Determine the Impact of Life-Cycle Manning on Lieutenants

Lewis, William I., Jr; Jun. 2005; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435903; No Copyright; Avail: Defense Technical Information Center (DTIC)

The U.S. Army has proposed a new manning strategy to reduce personnel turbulence and build strong cohesive combat units. Life-cycle manning would synchronize officer assignment with the 3-year life cycle of a Unit of Action (UA). This thesis uses simulation to examine the length of time an officer waits between graduation from the Basic Officer Leadership Course (BOLC) and assignment to a UA. The model is a discrete-event simulation based on a Java library called Simkit. This is a terminating simulation that provides the average delay lieutenants experience before unit assignment, over a 10-year period. The thesis uses robust design to evaluate both the mean performance and the variability of the system. By minimizing a quadratic loss function, optimal settings are determined that trade off some expected delay to achieve greater consistency. The analysis reveals that this system behaves like a queueing model in which officer accessions influence the arrival rate and the number of life-cycle units and their fill rates influence the service rates. Reducing officer accessions and the length of the life cycles while increasing the unit strength will keep the system stable and the expected delays smaller with greater consistency.

DTIC

Allocations; Armed Forces (United States); Combat; Life (Durability); Manpower; Personnel; Simulation; Synchronism

20050201120 Texas Univ., Austin, TX USA

Distributed Software Decision Support Systems for Heterogeneous Coordination in Chemical and Biological Response

Barber, K. S.; MacMahon, Matthew T.; Martin, Cheryl E.; Jan. 2002; 8 pp.; In English

Contract(s)/Grant(s): DAAA21-93-C-0101

Report No.(s): AD-A435982; No Copyright; Avail: Defense Technical Information Center (DTIC)

During detection and response to a Chem-Bio incident, heterogeneous groups, who may not ordinarily interact, must form a team. A Sensible Agent is a type of software agent (a Distributed Artificial Intelligence component that uses sensing, reasoning, and acting capabilities to achieve a set of goals) with additional coordination capabilities. For the Chem-Bio terrorism domain, Sensible Agents can offer the following decision-support capabilities: (1) belief revision based on models,

certainty and the trustworthiness of incoming information sources, (2) situation-based recommendations on the composition of decision-making groups, the relative strength of members of the group and over whom the group has authority, and (3) planning and resource allocation. This paper describes possible benefits of applying a Sensible Agent system to provide Chem-Bio detectors and responders with in situ decision support for task and resource management.

DTIC

Artificial Intelligence; Biological Effects; Coordination; Decision Support Systems; Heterogeneity; Physiological Responses; Software Engineering

20050201592 Department of the Navy, Washington, DC USA

A Method to Simulate Unsteady Turbulent Flows Using a Vorticity Based Method

Huyer, Stephen A., Inventor; Jun. 2005; 25 pp.; In English

Report No.(s): AD-D020207; No Copyright; Avail: CASI; [A03](#), Hardcopy

This patent application involves a computerized method for determining the velocity field of a three-dimensional fluid flow over a submerged body. Inflow velocities, turbulence, spectral behavior is provided over a body geometry. The method uses filament elements near the body and blob elements at a distance from the body. Velocity and vorticity are calculated at each time increment and then the elements are evolved based on the calculated values. Blob elements are moved using the centroid of the blob, and filament elements are moved by use the ends of the filaments. New elements are added as required upstream in the flow field. The time is incremented and the routine is repeated for a period of interest, providing a model of the flow field about the body. Hairpin filaments can be modeled by attaching multiple filaments end to end.

DTIC

Patent Applications; Turbulent Flow; Unsteady Flow; Vorticity

20050201712 NVI, Inc., Greenbelt, MD, USA

GSFC Technology Development Center Report

Himwich, Ed; Gipson, John; Gonzalez, Raymond; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 261-263; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities for the GSFC Technology Development Center (TDC) for 2004, and forecasts planning activities for 2005. The GSFC TDC develops station software including the Field System, scheduling software (SKED), hardware including tools for station timing and meteorology, scheduling algorithm, operational procedures, and provides a pool of individuals to assist with station implementation, check-out, upgrades and training.

Author

Technological Forecasting; Planning; Meteorology; Computer Programs

20050201716 National Inst. of Information and Communications Technology, Tokyo, Japan

VLBI Correlators in Kashima

Sekido, Mamoru; Koyama, Yasuhiro; Kimura, Moritaka; Takeuchi, Hiroshi; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 158-161; In English; See also 20050201697; Original contains color and black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Correlators at Kashima have been used for processing of experimental VLBI observations. The KSP correlation system has been used for domestic VLBI observations for geodesy in 2004. Instead of the decreasing frequency of using those hardware correlators, occasions to use disk-based recording system (K5) are getting more frequent. Two different disk-based recording systems have been developed. One is a multi-channel VLBI system named K5/VSSP and the other is a single channel Giga-bit system called K5/VSI. Data recorded with either of these disk-based recording systems are processed by software correlators. The correlation processing rate with software correlator is already in the range of practical use.

Author

Very Long Base Interferometry; Correlators; Correlation; Recording; Geodesy

20050201717 Geographical Survey Inst., Tsukuba, Japan

Tsukuba VLBI Correlator

Machida, Morito; Ishimoto, Masayoshi; Kurihara, Shinobu; Takashima, Kazuhiro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 162-165; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This is a report of the activities at the Tsukuba VLBI Correlator in 2004.

Author

Correlators; Very Long Base Interferometry; Geodesy

20050201753 Norwegian Defence Research Establishment, Norway

FFI Technology Development Center: Software Development

Andersen, Per Helge; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 259-260; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

FFI's contribution to the IVS as a Technology Development Center will focus primarily on the development and validation of the GEOSAT software for a combined analysis at the observation level of data from VLBI, GPS, and SLR. This report shortly summarizes the latest improvements of the GEOSAT software. FFI is currently Analysis Center for IVS and ILRS, Technology Development Center for IVS, and Combination Research Center for IERS.

Author

Computer Programming; Computer Programs; GEOSAT Satellites; Software Engineering

20050201755 Academy of Sciences (USSR), Saint Petersburg, USSR

Institute of Applied Astronomy Technology Development Center

Fedotov, Leonid; Ipatov, Alexander; Koltsov, Nikolay; Mardyshev, Vyacheslav; Mikhailov, Andrey; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 268-271; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The domain of IAA TDC includes the development of software and hardware for Russian VLBI network and QUASAR. This report describes IAA activities in this direction.

Author

Very Long Base Interferometry; Quasars; Computer Programs; Computer Programming

20050201772 Tamkang Univ., Taipei, Taiwan, Province of China

Quantifying the Learning Efficiency of Programming Learning and Its Implications

Shyu, Yuh-Huei; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 66-73; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

With the advent of distance learning, educators are having a hard time deciding whether to adopt this kind of education model or not. We need some metric systems to judge the superiority of different education models. To simplify the problem, our discussion will be restricted to programming language courses. Focusing on the issue of learning efficiency, in this paper, we will define some quantifiable parameters and measuring rules. These parameter values can reflect the features of the underlying education models. Derived parameter values not only reveal bottlenecks of the current programming learning processes, but also provide guidelines for designing better education models. The salient results are: (1). the learning inefficiency is in fact an intrinsic property of the traditional model itself, and (2). Active Teaching and Passive Learning for Novices. is a better teaching strategy for novices. Finally, combining all results we obtained, we propose the CD-type learning model. This model might provide a very efficient learning environment for novice programmers.

Author

Programming Languages; Learning; Mathematical Models

20050201776 National Jewish Medical and Research Center, Denver, CO, USA

Agile Systems for Clinical Research

Wade, Ted D.; Murphy, J. R.; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 74-82; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

Reliance on paper research records slows the progress of clinical research. Clinical culture and expensive and/or complex software impede the adoption of electronic methods. Institutions are addressing strategic issues like networks and knowledge bases for broad-based data sharing while ignoring the unmet need for flexible, affordable systems for basic data collection. We are evolving a system to replace paper records with an agile, metadata-based system that we hope will be quickly configured and maintained, readily understood, and self-documenting. We are currently testing the use of metadata-generated web forms to replace a paper/fax front end.

Author

Clinical Medicine; Metadata; Software Engineering

20050201778 Kyoto Univ., Japan

Reasoning Procedure and Implementation for Logic Programs as Managing Schemes to Extract Demand

Yamasaki, Susumu; Iwata, Kenichi; Sasakura, Mariko; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 83-90; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

We apply a nonmonotonic reasoning based on logic programming to the managing scheme to get information on some composition of assumed materials and demanded ones. This scheme can be applied to the infrastructure on the internet by extracting the demand for supply. To extract the demand for a composition, the well-renowned negation as failure rule is available in logic programming. Explicit negation may be included for expressive capabilities, for which some contradiction-removal procedure must be fairly implemented, to avoid the contradiction of a predicate competing with its explicit negation.

Author

Logic Programming; Demand (Economics); Architecture (Computers)

20050201781 Dublin City Univ., Dublin, Ireland

Programming Language Concepts for Global Computing

Ferreira, Ulisses; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 11-19; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

The present paper introduces a number of existing concepts about the programming language Plain that are useful for mobile agents and for the Internet programming, among other applications. This paper explores the ability to program with the unknown value, by preventing samples.

Author

Programming Languages; Computers; Internets

20050201802 Iwate Prefectural Univ., Iwate, Japan

Static Analysis of Lyee Requirements for Legacy System Software

Fujita, Hamido; Mejri, Mohamed; The IPSI BgD Transactions on Internet Research; January 2005, pp. 3-10; In English; See also 20050201801; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

Software development has been suffering, for many decades, from the lack of simple and powerful methodologies and tools. Despite the tremendous advances in this research field, the crisis has still not been overcome and the proposed remedies are far from resolving the problems of software development and maintenance. Lately, a new and very promising methodology, called Lyee, has been proposed. It aims to automatically generate programs from simple user requirements. The purpose of this paper is, on the one hand, to provide a short and technical introduction to the Lyee software development methodology, and on the other hand, to show how some classical static analysis techniques (execution time and memory space optimization, typing, slicing, etc.) can considerably improve many aspects of this new methodology. This paper contributes on introducing new techniques for software system design, for legacy systems.

Author

Software Engineering; Software Development Tools; Methodology; User Requirements

20050201804 New Univ. of Ulster, UK

Understanding and Reducing Web Page Latency

Curran, Kevin; Broderick, Nel; The IPSI BgD Transactions on Internet Research; January 2005, pp. 18-23; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

Studies have shown that surfers spend a lot of time impatiently waiting for Web pages to emerge on screen and HCI guidelines indicate ten seconds as the maximum response time before users lose interest. This paper presents research into the observed usage of Web images and the effect on page retrieval times. The prevalent factor that affects how quickly a Web site performs is the type of Web hosting environment that the site is deployed in. Web users are faced with sliding scale of delays in reality, with no one Web page taking the same time to load on two separate occasions. It is arguable that the magnitude and variance of network delay between a client and server are generally proportional to the distance spanned, assuming that all other influencing factors remain constant. Web can tweak their content to reduce the loading time of their sites.

Author

Websites; Image Processing; Computer Networks; Response Time (Computers)

20050201886 NASA Glenn Research Center, Cleveland, OH, USA

Cyclic Oxidation Modeling Program Rewritten for MS Windows

Smialek, James L.; Auping, Judith V.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Turbine superalloy components are subject to high-temperature oxidation during operation. Protection is often conferred by coatings designed to form slow-growing, adherent oxide scales. Degradation by oxidation is exacerbated by the thermal cycling encountered during normal aircraft operations. Cooling has been identified as the major contributor to stresses in the oxidation scales, and it may often cause some oxide scale spallation with a proportional loss of protective behavior. Overall oxidation resistance is, thus, studied by the weight change behavior of alloy coupons during high-temperature cyclic oxidation in furnace or burner rig tests. The various characteristics of this behavior are crucial in understanding the performance of alloys at high temperatures. This new modeling effort helps in the understanding of the major factors involved in the cyclic oxidation process. Weight change behavior in cyclic oxidation is typified by an initial parabolic weight gain response curve that eventually exhibits a maximum, then transitions into a linear rate of weight loss due to spalling. The overall shape and magnitude of the curve are determined by the parabolic growth rate, k_p , the cycle duration, the type of oxide scale, and the regular, repetitive spalling process. This entire process was modeled by a computer program called the Cyclic Oxidation Spalling Program (COSP) previously developed at the NASA Glenn Research Center. Thus, by supplying appropriate oxidation input parameters, one can determine the best fit to the actual data. These parameters describe real behavior and can be used to compare alloys and project cyclic oxidation behavior for longer times or under different cycle frequencies.

Author

Oxidation Resistance; Computer Programs; Heat Resistant Alloys

20050202017 Wayne State Univ., Detroit, MI, USA

Developing a Framework for Effective Network Capacity Planning

Yaprak, Ece; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 23-1 - 23-8; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A02](#), Hardcopy

As Internet traffic continues to grow exponentially, developing a clearer understanding of, and appropriately measuring, network's performance is becoming ever more critical. An important challenge faced by the Information Resources Directorate (IRD) at the Johnson Space Center in this context remains not only monitoring and maintaining a secure network, but also better understanding the capacity and future growth potential boundaries of its network. This requires capacity planning which involves modeling and simulating different network alternatives, and incorporating changes in design as technologies, components, configurations, and applications change, to determine optimal solutions in light of IRD's goals, objectives and strategies. My primary task this summer was to address this need. I evaluated network-modeling tools from OPNET Technologies Inc. and Compuware Corporation. I generated a baseline model for Building 45 using both tools by importing 'real' topology/traffic information using IRD's various network management tools. I compared each tool against the other in terms of the advantages and disadvantages of both tools to accomplish IRD's goals. I also prepared step-by-step 'how to design a baseline model' tutorial for both OPNET and Compuware products.

Author

Information Management; Internets; Computer Networks

20050202022 Pittsburgh Univ., Pittsburgh, PA, USA

An XML Representation for Crew Procedures

Simpson, Richard C.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 18-1 - 18-8; In English; See also 20050202011

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A02](#), Hardcopy

NASA ensures safe operation of complex systems through the use of formally-documented procedures, which encode the operational knowledge of the system as derived from system experts. Crew members use procedure documentation on the ground for training purposes and on-board space shuttle and space station to guide their activities. Investigators at JSC are developing a new representation for procedures that is content-based (as opposed to display-based). Instead of specifying how a procedure should look on the printed page, the content-based representation will identify the components of a procedure and (more importantly) how the components are related (e.g., how the activities within a procedure are sequenced; what resources need to be available for each activity). This approach will allow different sets of rules to be created for displaying procedures on a computer screen, on a hand-held personal digital assistant (PDA), verbally, or on a printed page, and will also allow intelligent reasoning processes to automatically interpret and use procedure definitions. During his NASA fellowship, Dr. Simpson examined how various industries represent procedures (also called business processes or workflows), in areas such as manufacturing, accounting, shipping, or customer service. A useful method for designing and evaluating workflow representation languages is by determining their ability to encode various workflow patterns, which depict abstract relationships between the components of a procedure removed from the context of a specific procedure or industry.

Investigators have used this type of analysis to evaluate how well-suited existing workflow representation languages are for various industries based on the workflow patterns that commonly arise across industry-specific procedures. Based on this type of analysis, it is already clear that existing workflow representations capture discrete flow of control (i.e., when one activity should start and stop based on when other activities start and stop), but do not capture the flow of data, materials, resources or priorities. Existing workflow representation languages are also limited to representing sequences of discrete activities, and cannot encode procedures involving continuous flow of information or materials between activities.

Author

Complex Systems; Crew Procedures (Preflight); Crew Procedures (Inflight); Continuum Flow; Document Markup Languages; Sequencing

20050202024 Houston Univ.-Clear Lake, Houston, TX, USA

Computer Simulation of the VASIMR Engine

Garrison, David; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 7-1 - 7-12; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; No Copyright; Avail: CASI; [A03](#), Hardcopy

The goal of this project is to develop a magneto-hydrodynamic (MHD) computer code for simulation of the VASIMR engine. This code is designed be easy to modify and use. We achieve this using the Cactus framework, a system originally developed for research in numerical relativity. Since its release, Cactus has become an extremely powerful and flexible open source framework. The development of the code will be done in stages, starting with a basic fluid dynamic simulation and working towards a more complex MHD code. Once developed, this code can be used by students and researchers in order to further test and improve the VASIMR engine.

Author

Magnetohydrodynamics; Computer Programs; Computerized Simulation; Relativity

20050203683 NASA Glenn Research Center, Cleveland, OH, USA, General Dynamics C4 Systems, Gilbert, AZ, USA, Southwest Research Inst., USA

Modeling and Analysis of Space Based Transceivers

Moore, Michael S.; Price, Jeremy C.; Reinhart, Richard; Liebetreu, John; Kacpura, Tom J.; [2005]; 4 pp.; In English; IEEE/NASA Software Engineering Workshop, 4-6 Apr. 2005, Greenbelt, MD, USA

Contract(s)/Grant(s): NNC04CB10C; No Copyright; Avail: CASI; [A01](#), Hardcopy

This paper presents the tool chain, methodology, and results of an on-going study being performed jointly by Space Communication Experts at NASA Glenn Research Center (GRC), General Dynamics C4 Systems (GD), and Southwest Research Institute (SwRI). The team is evaluating the applicability and tradeoffs concerning the use of Software Defined Radio (SDR) technologies for Space missions. The Space Telecommunications Radio Systems (STRS) project is developing an approach toward building SDR-based transceivers for space communications applications based on an accompanying software architecture that can be used to implement transceivers for NASA space missions. The study is assessing the overall cost and benefit of employing SDR technologies in general, and of developing a software architecture standard for its space SDR transceivers. The study is considering the cost and benefit of existing architectures, such as the Joint Tactical Radio Systems (JTRS) Software Communications Architecture (SCA), as well as potential new space-specific architectures.

Derived from text

Space Communication; Transmitter Receivers; Radio Communication; Computer Programs; Design Analysis; Software Development Tools; Computer Systems Design

20050203734 ManTech International Corp., USA

Goddard Space Flight Center's Structural Dynamics Data Acquisition System

McLeod, Christopher; 23rd Space Simulation Conference Proceedings; [2005]; 41 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Turnkey Commercial Off The Shelf (COTS) data acquisition systems typically perform well and meet most of the objectives of the manufacturer. The problem is that they seldom meet most of the objectives of the end user. The analysis software, if any, is unlikely to be tailored to the end users specific application; and there is seldom the chance of incorporating preferred algorithms to solve unique problems. Purchasing a customized system allows the end user to get a system tailored to the actual application, but the cost can be prohibitive. Once the system has been accepted, future changes come with a cost

and response time that's often not workable. When it came time to replace the primary digital data acquisition system used in the Goddard Space Flight Center's Structural Dynamics Test Section, the decision was made to use a combination of COTS hardware and in-house developed software. The COTS hardware used is the DataMAX II Instrumentation Recorder built by R.C. Electronics Inc. and a desktop Pentium 4 computer system. The in-house software was developed using MATLAB from The MathWorks. This paper will describe the design and development of the new data acquisition and analysis system.

Author

Commercial Off-the-Shelf Products; Computer Programs; Data Acquisition; Data Processing; Dynamic Structural Analysis

20050203741 Alaska Univ., Fairbanks, AK, USA

HTEST: A Configurable Triggered Data System for Simulating Space System Data Source Integration

Lisee, M.; Nance, K. L.; Hay, B.; 23rd Space Simulation Conference Proceedings; [2005]; 25 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The complex data-driven space systems of today and the future require the integration of potentially heterogeneous data sources. This requirement becomes even more complex when the integration has an associated interval requirement that is regular, periodic, or triggered. In some cases a collection of data sources are required to produce a timely input for the next phase. The controlled compilation of these data streams or sources is essential to contribute to effective automated or human decision support systems. This paper describes the HTEST System, a highly configurable test environment to simulate and test regular, periodic, and triggered compilation of heterogeneous data sources. The inputs to the system are 1) identification of a number of data sources and 2) integration rule identification. The integration rules provide the inputs necessary to use intelligent Petri net technology to control the timely integration of the data sources to maintain system integrity. The HTEST System was designed to test space system data sources and is being used to test subsystems integration for the IDACT System (a complex system for the identification, assimilation, collection and transformation of data sources). The IDACT and the HTEST test systems are being developed under NASA Advanced Information Systems Technology Program (NASA award AIST-02-0135).

Author

Programming Environments; Computerized Simulation; Space Environment Simulation; Data Integration

20050203817 Satya Wacana Univ., Salatiga, Indonesia

Parallel Implementation of Delaunay Triangulation on PVM based PC Clusters

Sediyono, Eko; Suhartanto, Heru; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 6 pp.; In English; See also 20050203815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Delaunay triangulation is a robust method for object reconstruction. In this paper we propose a parallel Delaunay triangulation technique and discuss the performance on Parallel Virtual Machine (PVM) based PC cluster. The research show that the parallel Delaunay triangulation algorithm applied to up to 400,000 points reached its best performance on five PC s connecting with Windows 2000 LAN. Index Terms PVM, Delaunay triangulation, speedup.

Author

Local Area Networks; Algorithms; Connectors; Triangulation; Parallel Processing (Computers)

20050203819 East Carolina Univ., Greenville, NC, USA

Faculty-Mentored Research and Project-based Teaching

Tabrizi, M. H. N.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004], pp. 1-7; In English; See also 20050203815; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper concerns the development of a faculty-mentored research and project-based software development program, which can be an effective education tool in teaching new software tools and languages in undergraduate and graduate studies. To illustrate the effectiveness of this proposed faculty-mentored software development program, a brief summary of the program along with evidence of the effectiveness of ad hoc pilot progress are introduced here and the primary methods are discussed. Evidence suggests that program works effectively when the projects are designed to serve the interests of the students. Using students to 'help' faculty research or grant activity is not what this program is about. Instead, the program is

designed to place students in charge of the discovery process. Thus, the students control the extent and duration of the undertaking.

Author

Computer Programming; Project Management; Software Engineering; Education

20050203822 Laboratoire d'Informatique Theorique et Programmation, Paris, France

An Approach To Control Multi-Agent Systems

Campagne, Jean-Charles; Cardon, Alain; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 13 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We investigate the possibility of analysis and control of large multi-agent systems by describing the system's activity and structure by shapes in an geometrical space, this notion is close to the phase-space in physics. Three organizations are involved in a closed systemic loop: the aspectual organization, the system to be controlled, is composed of a great number of light software agents. The second organization consists in morphological agents that try to describe the first organization configuration using shapes. And finally the analysis agents make use of the morphological description to control the aspectual organization. This paper briefly recalls the general key points of the model, from which the system is inspired. We then present an actual implementation of the system on an example.

Author

Feedback Control; Approach Control; Shapes; Loops; Computer Programs

20050203825 Skoevde Univ., Skoevde, Sweden

Natural Language Technology In Multi-Source Information Fusion

Gawronska, Barbara; Olsson, Bjoern; deVin, Leo; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 8 pp.; In English; See also 20050203815; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Information Fusion encompasses 'the theory, techniques and tools conceived for exploiting the synergy in the information acquired from multiple sources' [<http://www.inforfusion.org/mission.htm>]. The main issue is to improve the quality of decisions by utilizing several information sources (e.g. databases, sensors, simulations). Research on information fusion has focused on applications like robotics and command and control systems, but the need of information synergy concerns an increasing number of fields. Natural language (NL) serves as an important information source in all areas of human activity, but the integration of natural language into fusion systems is far from satisfactory. This paper discusses the employment of language technology in bioinformatics, and in industrial processes.

Author

Natural Language (Computers); Information Theory; Technology Utilization; Linguistics

20050203826 Kuwait Univ., Safat, Kuwait

On First Order Predicate Calculus in Procedural, Functional and Logical Programming

Almulla, M.; Loeper, H.; Deeb, F.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 6 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

First Order Predicate calculus is a formal language in which a wide variety of statements can be expressed; it is often used as a vehicle for knowledge representation. This paper explores the relationship between a subset of the first order predicate language that deals with finite data sets and programming languages of imperative, functional, and logical nature. It describes how to convert finite well-formed formulas into programming constructs, and to use those constructs to deduce new knowledge and/or to solve problems. The goal is to write computer programs equivalent to representations of quantified predicates. The paper also models a mapping that produces programs written in a procedural language (Ada 95), a functional language (SML), and a logic language (Prolog) for a combinatorial puzzle given in first order predicate calculus.

Author

Programming Languages; Predicate Calculus; Computer Programming; Combinatorial Analysis; Ada (Programming Language); Computer Programs

20050203827 Johann-Wolfgang-Goethe-Univ., Frankfurt am Main, Germany

What Configuration Can Learn from Parallelism and Vice Versa

Waldschmidt, Klaus; Klauer, Bernd; Hause, Jan; Eschmann, Frank; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 5 pp.; In English; See also 20050203815; Original contains black and white illustrations

Contract(s)/Grant(s): DFG-WA-357/15-2; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Configurable Architectures are the more flexible architectures in comparison to hardwired ASICs or processors. Unfortunately this flexibility is paid by a significant performance loss. In the first part of this paper we anticipate, that this flexibility/performance ratio can be inverted with the so called Medium and Large Grain Configurable Architectures. The reason for this assumption is parallelism that becomes exploited by large grain (re)configuration. Large grain configurable architectures are in our opinion clusters of workstations or PCs with a structure that is usually unknown at the compile time of the applications. As large grain configurable architectures we consider in this paper networks, which are configured after compile time and before run time as well as spontaneous networks with vanishing and appearing resources. Such architectures are used to exploit parallelism on applications as well as to increase the resource coverage of the participating computers. This assumption of what large grain configurability really is, raises a lot of problems to be solved at run time, like scheduling or binding of activities to dedicated or all-purpose machines. A solution to these problems is currently developed within the SDAARC-Project. In this project a COMA architecture is being extended to cover most aspects of parallelism and large grain (re)configurability. Index Terms Large grain configuration, parallelism, COMA, organic computing, SDAARC

Author

Architecture (Computers); Scheduling; Workstations; Losses; Computers

20050203829 France Telecom International, France

Automatic Configuration of Security Parameters in IP Networks

Adam, Yann; Salaun, Mikael; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 7 pp.; In English; See also 20050203815; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the Internet is becoming a tremendous support for numerous new services, the operational expenses (OpEx) have dramatically increased for the operator. The network must deal with more and more users, protocols and its configuration is becoming more and more complex and critical. Its automatic configuration would obviously help reduce the OpEx. This article presents emerging technologies (possibly IPv6-related) that might be used to setup an auto configurable network. The security issue is addressed as an applicability example by focusing on auto provisioning of security parameters (QoS is another example) and auto detection of DoS attacks in network equipment.

Author

Internets; Protocol (Computers); Support Systems; Security

20050203830 Panthesis, Inc., Bellevue, WA, USA

Load Balancing in a Swan Network of True Peers

Bourassa, Virgil; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 5 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As an alternative to client-server architectures, we have developed the Swan technology to support real-time interactive applications. Swan provides a communications fabric for multicast in ad hoc communities. In a Swan fabric every node is a true peer at the communications level. No matter how many nodes participate in a Swan fabric, each node contributes the same amount of communication resources as every other node in the session. A broad range of bandwidths can be accommodated in a Swan fabric. The bandwidth exhibited by the fabric will be some weighted combination of the bandwidths of all its nodes. There will be situations in which a session will be hosted by a computer which is known to have higher performance and greater bandwidth than most of the other participants. To bring these resources to bear, the application can have this more powerful computer participate as several nodes in the one session fabric. We here examine the challenge of balancing loads while maintaining the integrity of the Swan architecture and its benefits.

Author

Balancing; Computer Programs; Bandwidth

20050203877 NASA Glenn Research Center, Cleveland, OH, USA

CAD/CAE Integration Enhanced by New CAD Services Standard

Claus, Russell W.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A Government-industry team led by the NASA Glenn Research Center has developed a computer interface standard for accessing data from computer-aided design (CAD) systems. The Object Management Group, an international computer standards organization, has adopted this CAD services standard. The new standard allows software (e.g., computer-aided engineering (CAE) and computer-aided manufacturing software to access multiple CAD systems through one programming interface. The interface is built on top of a distributed computing system called the Common Object Request Broker Architecture (CORBA). CORBA allows the CAD services software to operate in a distributed, heterogeneous computing environment.

Derived from text

Computer Aided Design; Computer Aided Manufacturing; Data Acquisition

20050203897 Texas Univ., El Paso, TX, USA

Concept Visualizations of Computer Programs

d'Auriol, Brian J.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A major issue facing the programming world today is the quick and efficient understanding of existing program code by programmers and software engineers. Visualization of concepts inherent in the program code is proposed as a new mechanism to facilitate program comprehension. The premise of this research is that program comprehension is primarily based on the reader's conceptual formation of program code fragments. This paper identifies two novel visualization models called the Program-Scientific and the Conceptual Crown Visualization models; and presents preliminary visualization studies based on understanding programs from data processing, parallel computing and high performance computing applications.

Author

Computer Programs; Parallel Processing (Computers); Data Processing; Programmers

20050203900 Hungarian Academy of Sciences, Hungary

New Aspects of Software Quality in Components based Software Engineering

Feuer, Eva; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 5 pp.; In English; See also 20050203892

Contract(s)/Grant(s): EU-IST-2001-35485; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Wide spectrum of web services are available for the internet users. These services range from just reading the web pages to doing in e-business and technical services. Web services are built of grouped, reusable software components. The use of component based software development (CBSD) was assumed to offer many benefits in software engineering, including reduced time to market, reduced development costs, and improved productivity on the other hand raises several issues. The components used are often made by a third-party, sometimes unknown source black-boxes. In order to take the advantages of component based development, it is very important to have information about the quality of components. In this paper we describe how the generic software quality models apply to CBSD and what special attributes should be introduced for components.

Author

Computer Programming; Software Engineering; Cost Reduction; Commerce

20050203906 East Carolina Univ., Greenville, NC, USA

Teaching Project-Based Undergraduate Software Engineering Courses

Tabrizi, M. H. N.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reports on the effectiveness of a project-based software development program in teaching undergraduate software engineering and other related courses. The partial listing of the author's recent undergraduate software engineering projects involving the students are listed here. It is important to notice that the students were encouraged to consider the software platforms that were easy of use and effective in self learning, more suitable in software engineering environment, and help students to compete with the others in job market. To illustrate this, a brief summary of the program along with evidence of the effectiveness of an ad hoc pilot progress are introduced and the primary methods are discussed. This program works well if the projects are designed to serve the interests of the students because it is designed to place students in charge of the discovery process and control the extent and duration of learning. The assessment of the effectiveness of the program with the planned future statistical tests, graphical qualitative multivariate analysis, and the reviews free comments are discussed.

Author

Education; Software Engineering; Programming Languages

20050203907 Ateneo de Manila Univ., Makati City, Philippines

Redefining Specific Processes of the Philippine Judicial System Into Internet-Driven Paradigms

Vitangcol, S, III; Red, John Noah M.; Borja, Cyrus P.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study focuses on how existing Internet technologies might not only automate but also transform the practice of, and access to law. As the Internet thrives on the continuing stream of dramatic improvements in hardware, software, communications technologies, and the applications designed for it, it thus offers new and creative solutions in implementing specific processes in the Philippine judicial system. The paper centers on redefining specific processes of the judicial system into Internet-driven paradigms. The results of the study can be used as models for application systems development, which can subsequently contribute to the improvement of judicial services and ultimately dispensation of justice in the Philippines.

Author

Internets; Philippines; Law (Jurisprudence); Communication Networks

20050203918 Axiowave Networks, Inc., Marlborough, MA, USA

Quality of Service Requirements for IP/MPLS Routers

Toy, Mehmet; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 6 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As high quality and demanding services, such as Voice over IP (VoIP), are being offered over IP/MPLS networks, the quality of service (QoS) requirements for IP/MPLS networks are becoming tighter. Best effort networking is no longer adequate. Low delay and jitter for premium traffic in the presence of bursty traffic, and 99.999% availability are minimum requirements to support new applications. This paper will describe requirements for IP/MPLS routers to support emerging IP/MPLS network applications. The impact of CapEx (Capital Expenses) and OpEx (Operating Expenses) not being able to support these requirements are also discussed.

Author

Graphical User Interface; Document Markup Languages; Industries; Computer Networks

20050203927 Illinois Inst. of Tech., Chicago, IL, USA

Dynamic Aspect Oriented C++ for Application Upgrading Without Restarting

Almajali, Sufyan; Elrad, Tzilla; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 12 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents an extension to C++ to construct easily upgradeable systems without restarting. With current applications of the Internet, the need for new structures to achieve a high degree of dynamic adaptability becomes apparent. Here we propose to address the issue of modularization of networking services whose implementation would otherwise be scattered in many different places. The advantage of such modularization is that these services become easier to control and adapt at runtime. The cost of extracting what otherwise would be scattered code and modularizing it is the need to provide

mechanisms to quantify the points in the program where the code needs to run. In addition, the issue of switching from one system version to another is addressed. The paper presents the DAO C++ language - Dynamic Aspect Oriented C++ system, its implementation and its potential use for dynamic applications upgrading.

Author

C++ (*Programming Language*); *Adaptation*; *Dynamic Programming*

20050203929 Association for Computing Machinery, Pittsburgh, PA, USA

Using Pattern to Reduce Compilation Dependencies in Large Scale C++ Project

Amjad, Zeeshan; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 6 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Developing a large-scale project is a challenging task. There are lots of issues in a large-scale project, which are invisible in small projects. One such issue is the compilation time that becomes very large if project is not organized properly. Design Patterns, which helps making logical design of the project, can also be used to manage the physical dependencies of a large-scale C++ project.

Author

C++ (*Programming Language*); *Pattern Method (Forecasting)*

20050203952 Ching Yun Univ., Chung-Li, Taiwan

Sun Tzu and e-Strategy of Intellectual Property Right (IPR)*

Chang, Muchiu; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper, we explore the philosophical foundation for the e-strategy of intellectual property right (IPR) based on 'Sun Tzu: The Art of War'. First of all, we find that using modeling and simulation for evaluation and decision making is a modern trend of implementing Sun Tzu's concept of 'temple calculation'. Our patent-pending works in virtual validation and verification of product specifications by modeling simulation have strategic importance in securing a market. Second, Sun Tzu's defensive philosophy of 'securing ourselves first' is preferable because IPR is a protracted combat. From the human-brain orientation of IPR, we propose to allow the individual member who creates the innovations to hold the IPRs of his innovations and share the profit that come from his IPRs, which is a corporation model of 'I pay, we work, we win and we share', so that there are incentives to encourage people to think and offer the solutions, and let the innovators free from the worry of being expendable. Finally, from our study of US patent database, we notice that IPR can bring new opportunities to individuals with know-how and skill, while INTERNET and world wide web (WWW) along with open source software provide a new platform for innovators in education (e-learning), creating innovation and manipulating marketing and strategy with low cost.

Author

Brain; *Decision Making*; *Intellectual Property*; *Marketing*

20050203954 Conselho Nacional de Pesquisas, Brazil

A Prolog-like Language for the Internet

Ferreira, Ulisses; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 12 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a three-valued logic programming language which permits definitions of clauses under closed-world assumption or without it, due to the presence of a constant (referred to as uu) at the language level. A third truth value is used to provide only one negation, defined here as abstract negation, while Extended Logic Programs adopt two kinds of negation. I present an operational semantics for both propositional and the predicate forms, including variables. The language can be seen as an adaptation of Prolog capable of capturing lack of information. In particular, the language can be viewed as as an

appropriate compromise solution between logic and a global structure such as the Internet. Little work has been done combining logic with such a platform.

Author

Programming Languages; Logic Programming

20050203955 Middlesex Univ., UK

Problems and Prospects for E-Manufacturing

White, A. S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 17 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reviews the current major issues in the implementation of e-manufacturing, particularly the dynamic aspects. It will examine the progress in the last few years, drawing out particular issues that need to be addressed. Use will be made of the work by the author and colleagues to devise rulebased design and Internet based control of machines to illustrate how these developments affect the integrated e-manufacturing environment. A set of dynamic Simulink models of the way e-manufacture is affected by the overall design delays are used to evaluate general solutions for partial and complete e-based companies. These models show how changing to improved designs reduces WIP. Suggestions for new software to aid e-manufacture are made.

Author

Manufacturing; Electronics; Computer Systems Design; Inventory Management

20050203956 Tokyo Inst. of Tech., Tokyo, Japan

Autonomy for System Assurance under Evolving Situations

Mori, Kinji; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The markets have been changing rapidly and the users preferences are much more difficult to predict. Under the evolving situations, the heterogeneous systems are connected and the heterogeneous modes and requirements coexist in the systems. Then the system is required to keep its operation under these dynamic situations, that is, the system assurance. For attaining the assurance, the system design view, the technologies and the key issue of the autonomy for the assurance are discussed with the real application systems. These assurance technologies are shown to be effective in these applications.

Author

Autonomy; Market Research; Systems Engineering; Rail Transportation

20050203957 van Meulebrouck (Andre), CA, USA

Desideratum: Simple Syntax!

vanMeulebrouck, Andre; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 30 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This position paper asserts that the computer industry suffers needless losses in manhours and productivity due to gratuitous complexity. One culprit is complex syntax. The antidote is parsimonious syntactic constructs so that parsing does not become a science in and of itself. I propose a two step parsing process. The preprocess phase translates alternate syntaxes, macros, and other directives into engine syntax. This allows verifying that alternate syntaxes produce equivalent code. It is also in the best interests of accuracy, and expedites mechanized code generation. The LISP s-expression would be the ideal lingua franca syntax for software engines.

Author

Syntax; Computer Programming; Lisp (Programming Language); Complex Systems

20050203958 Ateneo de Manila Univ., Quezon City, Philippines

Framework for an Internet-Based National Electoral System: The Philippine Scenario

Vitangcol, Al S., III; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 12 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Internet thrives on the continuing stream of dramatic improvements in hardware, software, and communications technologies. Another important factor driving the growth of the Internet are the applications designed for it, making information and delivery of services instantly and conveniently accessible to geographically dispersed individuals. It is changing the way things are done, so to speak. These dramatic changes are not confined to businesses alone but more so to the efficient and effective delivery of public services, giving rise to G2C model and EGovernment. According to Deloitte Research scale, there are six (6) stages of EGovernment, but this paper would center only on Stage 2 Official two-way transactions between the government and its citizens. The paper would focus on solutions and suggestions to a specific area the national electoral system. The paper would attempt to develop a framework for an Internet-based national electoral system for the Philippines taking into account a multitude of factors that would affect such a framework. The framework design would touch upon the whole gamut of processes, from multilingual website design to application, down to many diverse issues like technology, culture, content management, legal, security, and implementation, among others.

Author

Internets; Philippines; Voting; Telecommunication

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20050200834 Naval Postgraduate School, Monterey, CA USA

Capture-the-Flag: Learning Computer Security Under Fire

Eagle, Chris; Clark, John L.; Jul. 2004; 6 pp.; In English

Report No.(s): AD-A435319; No Copyright; Avail: CASI; [A02](#), Hardcopy

In this paper, we describe the Capture-the-Flag (CTF) activity and argue that it contributes to a necessary component of the computer security curriculum. This component is the study of software vulnerability investigation. It is currently not properly emphasized in this curriculum. We discuss reasons for this situation and we go on to describe how CTF can be useful for educating students within this focus. CTF helps develop those computer security skills that enable students to identify new vulnerabilities before those with malicious intent find them. It also helps them to hone the core computer security skills.

DTIC

Computer Information Security; Fires; Learning; Military Personnel; Students

20050200843 Indiana Univ.-Purdue Univ., Fort Wayne, IN USA

An Implementation of CuPiDS: Evaluating the Effectiveness of Multi-Processor Information System Security

Williams, Paul D.; Jan. 2005; 13 pp.; In English

Report No.(s): AD-A435378; CI04-1128; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Co-Processing Intrusion Detection System (CuPiDS) project explores practical improvements in information system security and survivability through dedicating computational resources to system security tasks in a shared resource, multi-processor (MP) architecture. Our research explores ways in which this architecture offers improvements over the traditional uni-processor (UP) model of security. This paper describes the details of an implementation of such a system. This prototype is used to validate our research theses and explore some of the performance benefits and trade-offs of dedicating computational resources to computational tasks as well as the cost of creating and using such a system.

DTIC

Computer Information Security; Detection; Information Systems; Multiprocessing (Computers); Parallel Processing (Computers); Security; Warning Systems

20050200848 Defense Acquisition Univ., Fort Belvoir, VA USA

Computer Security: A Summary of Selected Federal Laws, Executive Orders, and Presidential Directives

Moteff, John; Apr. 2004; 17 pp.; In English

Report No.(s): AD-A435394; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report provides a short summary of selected federal laws, executive orders, and presidential directives, currently in force, that govern computer security. The report focuses on the major roles and responsibilities assigned various federal agencies in the area of computer security. This report will not be updated. One major area of federal activity in computer security deals with securing federal computer systems. The roles and responsibilities for securing federal computer systems are split between national security systems and all other federal systems. The Federal Information Security Management Act of 2002 authorizes the Director of the Office of Management and Budget to oversee the development of, and compliance with, security standards and guidelines, developed by the National Institute of Standards and Technology and promulgated by the Secretary of Commerce. These authorities, however, do not apply to computer systems considered to be national security systems. The roles and responsibilities for securing national security systems are established by National Security Directive 42 (NSD-42). NSD-42 establishes what is now called the Committee on National Security Systems, which it authorizes to develop, and require compliance with, standards and guidelines for national security systems.

DTIC

Computer Information Security; Law (Jurisprudence); Laws; Presidential Reports

20050200872 Naval Postgraduate School, Monterey, CA USA

Quantifying Effect of Network Latency and Clock Drift on Time-Driven Key Sequencing

Xie, Geoffrey G.; Irvine, Cynthia; Levin, Tim; Jan. 2002; 9 pp.; In English

Report No.(s): AD-A435468; No Copyright; Avail: Defense Technical Information Center (DTIC)

Time-driven Key Sequencing (TKS) is a key management technique that synchronizes the session key used by a set of communicating principals based on time of day. This relatively low cost method of session key synchronization has been used in specialized distributed systems with low-end communicating devices where sessions are sparse and each session spans a short time period comprising a small number of messages. In this paper, we describe how TKS may be useful in several scenarios involving high speed computer networks. More importantly, we present a performance model of TKS and conduct a detailed analysis to determine the impact of clock drift and network latency on the required key refresh rate. We give the exact conditions for determining the range of adequate key refresh rates, and demonstrate that the derived conditions are sufficient to ensure that data are both protected and deliverable. Interestingly, these conditions may be used to obtain a key refresh rate that can tolerate a maximum amount of clock drift after other parameters in the system are fixed.

DTIC

Computer Networks; Sequencing; Time Measurement

20050200890 Naval Postgraduate School, Monterey, CA USA

Evaluation of Two Host-Based Intrusion Prevention Systems

Labbe, Keith G.; Jun. 2005; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435506; No Copyright; Avail: Defense Technical Information Center (DTIC)

Host-based intrusion-prevention systems are recently popular technologies that protect computer systems from malicious attacks. Instead of merely detecting exploits, the systems attempt to prevent the exploits from succeeding on the host they protect. This research explores the threats that have led to the development of these systems and the techniques many use to counter those problems. The author then evaluates two current intrusion-prevention products (McAfee Entercpt and the Cisco Security Agent) as to their success in preventing exploits. His tests used live viruses, worms, Trojan horses, and remote exploits that turned loose on an isolated two-computer network. The author then makes recommendations about deployment of the two products based on the results of this testing. Testing procedures for the remote exploit, e-mail exploit, disk exploit, and web phase exploit are appended.

DTIC

Computer Networks; Evaluation; Internets; Intrusion; Prevention; Protocol (Computers); System Effectiveness

20050200894 Naval Postgraduate School, Monterey, CA USA

Developing a Fly-Away-Kit (FLAK) to Support Hastily Formed Networks (HFN) for Humanitarian Assistance and Disaster Relief (HA/DR)

Lancaster, David D.; Jun. 2005; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435513; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research discusses developing a FLY-Away-Kit (FLAK) to support the forming of Hastily Formed Networks (HFNs) in remote areas in support of Humanitarian Assistance and Disaster Relief (HA/DR) operations. The initial focus will be on the requirements, situation, area of operations, and mission. Different definitions and perspectives emerge when an individual mentions HFNs, HA/DR and Complex Humanitarian Disasters (CHDs). It is the author's intention to define and describe both a HFN and a CHD to justify the need for the FLAK. This process will also define the requirements for the FLAK as well as facilitate processes for ensuring those requirements are met. The personnel responding to the attacks of September 11, 2001 and the December 26, 2004 Southeast Asia Tsunami suffered Command and Control (C2) and information challenges. Even more challenges are being currently addressed by Homeland Defense, Maritime Domain Awareness, and Non-Governmental Organizations (NGOs) abroad. From the top down, levels of administration are developing new plans, procedures, and organizations that will improve the security and communication processes of our nation. A global, broadband, rapidly deployable network node complete with Internet reach-back, voice, data, and video capability is of the utmost importance to enable C2 and Network Centric Operations (NCO). Undoubtedly, commercial and military organizations, traditional or new, will greatly benefit from this capability. The U.S. DoD is particularly interested in improving interaction, coordination, communications, and operations when DoD and other entities respond simultaneously to natural or man-made CHDs.

DTIC

Broadband; Command and Control; Communication Networks; Disasters; Emergencies; Kits; Management Methods; Warfare

20050200937 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

Telechemistry, Projecting Laboratory Expertise to a Deployed TAML

Slife, Harry F.; Schofield, Matthew; Oct. 2003; 18 pp.; In English

Contract(s)/Grant(s): MIPR-3GD3E33087; MIPR-4HBCNM4077

Report No.(s): AD-A435612; No Copyright; Avail: CASI; [A03](#), Hardcopy

The 520th Theater Army Medical Laboratory (TAML) is a unique Army asset with worldwide responsibility to deploy on short notice and conduct health surveillance as part of a comprehensive Force Health Protection Program. The TAML is staffed by permanent party enlisted and officers and augmented with Professional Filler System (PROFIS) officers upon deployment. The staff is required to set up, operate, maintain, and troubleshoot sophisticated, delicate, analytical equipment in a hostile environment. Training of TAML soldiers on analytical chemistry techniques is the joint responsibility of the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) and the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) who, collectively, possess the expertise needed by the TAML soldiers for analysis, data interpretation, troubleshooting, and consultation. However, implementing a comprehensive training plan has been undermined by routine deployments and the constant turnover of TAML personnel. We have addressed these issues using telemedicine technology to link the TAML to the experts in instrument operations and data analysis residing in these partnership units. The proposal was conducted in three phases; Equipment Procurement and Training, Proof of Concept, and Concept Validation. All tested scenarios met or exceeded established operating standards. By all measures the proposal was determined to be successful and to tremendously enhance the TAML's operational capability.

DTIC

Deployment; Telemedicine

20050201627 Naval Postgraduate School, Monterey, CA USA

Web-Based Dissemination System for the Trusted Computing Exemplar Project

Kane, Douglas R., Jr; Jun. 2005; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435485; No Copyright; Avail: Defense Technical Information Center (DTIC)

Open dissemination of the Trusted Computing Exemplar (TCX) project is needed. This dissemination must include methods to provide secure web access to project material, integrity verification of data, and group-based access controls. Because previously developed dissemination systems do not meet these requirements, a hybrid web-based dissemination system is necessary. The development of the TCX Dissemination System requirements involved the analysis of assumptions, threats, policies, and security objectives for the system and its environment based on the Common Criteria methodology. The requirements yielded a design specification that included a dissemination application that uses XML capabilities for redaction and preparation of releasable materials. This led to the creation of an initial implementation to satisfy a subset of the TCX dissemination requirements. Future work was identified for a subsequent implementation that fulfills additional project requirements. The complete implementation of the dissemination environment described in this thesis will provide a seamless dissemination interface for the TCX project. The Dissemination System provides an example of how controlled information can be organized and made available on the web. When combined with TCX project results, it supports the assured information

sharing objectives of the Department of Defense Global Information Grid vision.

DTIC

Security; Warning Systems; Access Control; Document Markup Languages

20050201672 Naval Postgraduate School, Monterey, CA USA

IPSEC-Based Dynamic Security Services for the MYSEA Environment

Horn, John F.; Jun. 2005; 132 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435523; No Copyright; Avail: Defense Technical Information Center (DTIC)

It is recognized that security services in information-processing systems require access to finite resources in the execution of their duties. In response to the changing threats faced by a system and/or the availability of system resources, it is desired that the system be able to adjust its operational security policies automatically while continuing to function under an acceptable global security policy. This work involves the analysis and integration of a dynamic security service (DSS)-enabled IPsec implementation into a form ready for installation into the MYSEA environment. The feasibility of dynamic security services is demonstrated with support for secrecy and/or integrity protection of MLS server-to-end-user communication via a Trusted Path Extension. This is accomplished through the modulation of the IPsec security associations to adapt to operational needs. The result of this research is beneficial to Homeland Security, the Department of Defense, and the intelligence community by enabling remote distributed computing clients to operate in a secure manner that remains flexible to adapt to changing requirements of protection on the network and the availability of resources on terminating hosts. Furthermore, these methods can aid the realization of high-assurance edge-client connectivity in the creation and extension of the Global Information Grid (GIG).

DTIC

Security; Defense Program; Computer Networks

20050201734 NVI, Inc., Greenbelt, MD, USA

CORE Operation Center Report

Thomas, Cynthia C.; MacMillan, Daniel; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 139-142; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report gives a synopsis of the activities of the CORE OPERATION Center from January 2004 to December 2004. The report forecasts activities planned for the year 2005.

Author

Correlators; Very Long Base Interferometry; Forecasting

20050201801 IPSI BgD Internet Research Society, New York, NY, USA

The IPSI BgD Transactions on Internet Research, Volume 1, Number 1

January 2005; ISSN 1820-4503; 96 pp.; In English; See also 20050201802 - 20050201813; Original contains black and white illustrations; Copyright; Avail: CASI; [A05](#), Hardcopy

This paper presents The IPSI BgD Transactions on Internet Research. The topics include: 1) Static Analysis of Lye Requirements for Legacy System Software; 2) A Distributed Multimedia Information System for Cultural Heritage identity preservation; 3) Understanding and Reducing Web Page Latency; 4) Modelling and Analysis of Agent-Based Electronic Marketplaces; 5) Introducing a New Infrastructure Element for E-Business Financial Reporting: an Internet Clearinghouse; 6) Broadband Infrastructure and Rural Regional Development in Norway; 7) An Information Retrieving Service for Distance Learning; 8) Towards a methodology for evaluating the quality of (public) websites; 9) Access Control for e-Business on MOPASS; 10) Critical Skills and Knowledge in Development of e-commerce Infrastructure; 11) Biometric Features for Mobile Agents Ownership; and 12) Using Technology to Conduct Research in Education

CASI

Information Systems; Internets; Research

20050201805 Bologna Univ., Italy

Modelling and Analysis of Agent-Based Electronic Marketplaces

Fortino, Giancarlo; Garro, Alfredo; Russo, Wilma; The IPSI BgD Transactions on Internet Research; January 2005, pp. 24-33; In English; See also 20050201801; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

In this paper, an approach for modelling and analysing e-Marketplaces based on agents is proposed. The approach is founded on a Statecharts-based specification language and on a Java-based, discrete event simulation framework. The former

allows for the modelling of the behaviour of the main agents (stationary and mobile) of an e-Marketplace along with their interaction protocols. The latter supports the execution through simulation of agent-based e-Marketplace models. The approach is exemplified by defining and simulating a consumer-driven e-Marketplace model which offers mobile agent-based services for searching and buying goods. The simulation phase enabled validation of the e-marketplace model and evaluation of the performances of different kinds of mobile consumer agents.

Author

Electronic Commerce; Models; Computer Systems Design; Marketing; Systems Analysis

20050201806 City Univ. of New York, NY, USA

Introducing a New Infrastructure Element for E-Business Financial Reporting: an Internet Clearinghouse

Gottlieb, Max; Stavovski, Boris; The IPSI BgD Transactions on Internet Research; January 2005, pp. 34-40; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

A new infrastructure element for e-business financial reporting (an internet clearing house) is introduced. It would be advisable to distribute financial reports via an electronic clearinghouse. This method would permit instant access to the reports and assure that these documents could not be modified. The existing reporting frequencies are reviewed, contrasting them with the needs of investors, and the generation of accounting transactions is described. Next, the proposed method of collection and distribution of financial reports as well as their possible analyses by a central electronic clearing house is discussed. Finally, the need for changes of the attestation standards is analyzed, ways to assure the integrity of distributed electronically financial statements are proposed, and the rational sequence of implementation of the new distribution is generated.

Author

Electronic Commerce; Internets; Finance; Systems Engineering

20050201808 Antwerp Univ., Belgium

Towards a Methodology for Evaluating the Quality of (public) Websites

Neuner, Cornelia; DeLandtsheer, Christ'l; The IPSI BgD Transactions on Internet Research; January 2005, pp. 57-64; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

Creating a successful website is not easy. This is an obvious conclusion when looking at sites that are difficult to navigate, find information from or interact with. As users, we are struggling with poorly designed and implemented sites. As researchers, we need to tackle the problem in a new way. It is important to understand that it is not enough to make a website functional but also usable, appealing, compelling and engaging from a user's point of view. The art of creating engaging websites needs new interdisciplinary approaches presenting perspectives from communication studies, film and media analysis, graphic design, architecture, development of digital technologies and computer science, etc. as well as a psychological understanding of the human being as an emotive, sensuous, cultural, intellectual and social being.

Author

Websites; Methodology; Telecommunication

20050201812 National Research Council, Italy

Biometric Features for Mobile Agents Ownership

Vitabile, Salvatore; Pilato, Giovanni; Conti, Vincenzo; Gioe, Giuseppe; Sorbello, Filippo; The IPSI BgD Transactions on Internet Research; January 2005, pp. 81-89; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

Multi-Agent System (MAS) architectures can be used for e-Business application due their flexibility, scalability and interoperability. Agent ownership implies that a specific person or organization (the owner) is responsible for the agent's actions. Agents, whose ownership was certainly fixed, could operate on behalf of their owner to make transactions, to buy or sell products. Security requirements in the agent ownership setting process are the identification of the owner and the protection of the identification information carried by an agent. In this paper, we investigate the possibility of using biometrics in mobile agent systems for owner authentication. Biometric features can be used in both agents ownership setting process and in the protection of the agents information. Certification Authorities could also check against the owner reputation level before grant or deny permission of performing certain actions. In order to show the feasibility of the approach, the proposed techniques have been implemented and tested as an extension of the JADE-S platform.

Author

Biometrics; Architecture (Computers); Computer Information Security; Mobile Communication Systems

20050203736 Lockheed Martin Corp., Sunnyvale, CA, USA

Thermal Vacuum Operating System

Diehl, Manfred; 23rd Space Simulation Conference Proceedings; [2005]; 22 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation profiles a robust and user friendly software package to acquire data and control heat in large vacuum facilities. The presentation addresses: 1) System Layout; 2) Subsystem Responsibilities; 3) Software Interface; 4) Fail Safes for the Thermal Vacuum Operating System (TVOS).

Derived from text

Vacuum Systems; Test Facilities; Control Systems Design; Applications Programs (Computers)

20050203737 Boeing Co., Huntington Beach, CA, USA

Update: Remote Control of Data Acquisition and Control Systems via the Internet

Patel, Atul; Bauer, Robert; 23rd Space Simulation Conference Proceedings; [2005]; 22 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Boeing Company Structures Test Laboratory in Huntington Beach, California, has developed and implemented a system architecture that allows remote access and control of its data acquisition and control systems. The backbone of the system utilizes the site network and remote control software that is commercially available. The server system supports remote display of real-time data while restricting access to properly authorized individuals. This paper describes the server implementation and security features that allow different customers to access their data without having access to other information on the server. By restricting access, the data is protected and can only be viewed by individuals who are authorized to evaluate it. The paper summarizes the design of the system and the Internet tools employed that have made it possible to share test data and remotely control test equipment. The paper also presents the user-friendly interfaces and describes the capabilities of the system.

Author

Remote Control; Network Control; Data Acquisition; Internets; Control Systems Design; Computer Systems Design

20050203818 Universidad Politecnica de Madrid, Madrid, Spain

VESTA: A High Flexibility and Low Granularity Domotic Platform Based on Distributed Processing over a Dynamic Interconnection Wireless Network

Nieto-Taladriz, Octavio; Araujo, Alvaro; Aguei, Juan; Quintana, Alberto; Carreras, Carlos; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinary (IPSI-2004); [2004]; 5 pp.; In English; See also 20050203815; Original contains color illustrations

Contract(s)/Grant(s): TIC2000-1395-C02-01; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes the Domotic Platform VESTA which is built with two types of components, called Antares and Mercurio, that can be mixed in any number and can interface with each other and with commercial and non commercial devices. Antares is the processing platform built around a Motorola Coldfire processor with an embedded CLinux operating system. Mercurio is a low power battery operated radio modem that includes an 8051 microcontroller for dynamic networking operations. The complete system is based on a distributed approach, both in processing and networking, achieved through dynamic data routing around the network, dynamic reconfiguration of the network, and interoperability with EIB standards. Data mining and contents distribution algorithms have been integrated for some applications. The applicability of the platform is demonstrated through two application cases: a system to reduce energy consumption in hotels funded by the Islas Baleares Government, and a fertirrigation and climate control for greenhouses and extensive crop systems funded by Spanish agricultural associations.

Author

Algorithms; Computer Networks; Data Processing; Distributed Processing

20050203820 ACCESS Co. Ltd., Tokyo, Japan

A Mobile Internet Service Evolution Model: Implications for the Future Mobile Web Service Development from Japanese Experience

Yamakami, Toshihiko; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 7 pp.; In English; See also 20050203815; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The mobile Internet reached 68 millions in Japan during its 5-year evolution. In addition to the various technical issues to push mobile Internet deployment, it is a challenging research topic how the mobile Internet services penetrate into the daily use. The micro-browsers on mobile handsets have a wide range of restrictions from battery life to the display size limitations. In order to remove these barriers and drive the mobile Internet services, it is important to capture the key issues in the mobile Internet service diffusion. The author provides a 5-staged evolution model for the mobile Internet services. In addition, the author gives a 2-dimensional model to drive the evolution using the two dimensions: modality and procedure functions. In order to overcome various obstacles in the usability in the mobile handsets, it is important to deploy the service introduction strategies that are aware of the mobile Internet characteristics. The mobile Internet service consumers are sometimes very demanding even with the inherited constraints in the mobile handsets. The 5-year empirical observation gives how the two factors drove the service evolution and how the 5 stages were related to the two dimensions. From this bottom-up observation, the author gives implications for the future mobile service evolution and guidelines for service development.

Author

Internets; Deployment

20050203828 Kyushu Univ., Kasuga, Japan

Building Agent Networks for Ubiquitous Computing

Amamiya, Makoto; Zhong, Guo-Qiang; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 8 pp.; In English; See also 20050203815; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With today's developments in device miniaturization, wireless networking, such as PCs, PDAs, Cell phones, RFID tags and so on, our community is facing great opportunities and challenges to realize the ubiquitous computing vision. In this paper, we first identify the key characteristics of ubiquitous computing systems; then argue that agents and agent networks are the right metaphor for managing the dynamism and complexity of system integration and on demand interactions in ubiquitous computing systems. To make the discussion more concrete, a case study of a location- and context-dependent shopping-support system is also presented.

Author

Computer Vision; Systems Integration; Support Systems; Miniaturization; Computers

20050203833 Institute of Electrical and Electronics Engineers, Accra, Ghana

Internet and the Challenges Most Industries in Ghana Face: Internet Engineering

Asiedu, Timothy Kwadwo; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 8 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The use of Internet in the Ghanaian economy has become so prevalent that, not a single day passes that you don't hear someone saying that I am going to the Internet Cafe or the Business center to browse. Both young and the old are all involved; and it appears that if you don't join the Internet wagon you will be left out. The Private, Public and the Government set-ups are all discovering the wealth of potentials the Internet can offer. Out of about Ghana's population of about 19.8 million, we have about say 19 % who use the Internet. What this paper seeks to do is to identify the challenges most industrial set-ups involved in the use of the Internet face in Ghana and how best the identified problems could be resolved. In discovering some of the challenges some of the business set-ups face, the author spent some time interviewing the Chief Executive Officers (CEOs) of these set-ups. Through discussions with some of the CEOs, it was found out that the load in terms of clients on some of the Internet Service Providers (ISPs) is too much and at times a small problem, which could be resolved in a short time, can take a very long time. Some CEOs of this set-ups also think they are spending too much in terms of money and time in getting the infrastructure for the Internet alright, and if services of these ISPs do not improve they will change their existing ISPs or close down their business.

Author

Internets; Industries; Commerce

20050203893 Saint Thomas Univ., Saint Paul, MN, USA

RSS, OPML and Weblog Ecosystems: A Survey of New Technologies in Internet Publication

Bass, Douglas W.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

With the rapid growth of weblogs (or 'blogs') over the past year, users require a way of rapidly accessing recent content from many different websites. Traditional websites are inadequate for this, as their content and presentation information are inseparably intertwined. This paper describes the development of the RSS (Really Simple Syndication) specifications as a solution for this problem. This paper also describes the RSS readers or aggregators used to process content in the RSS format, the growth in the use of Outline Processor Markup Language (OPML), and the development of environments for ranking the relative importance of blogs (commonly known as blog ecosystems).

Author

Ecosystems; Internets; Surveys; Websites

20050203904 Alpha Mission, Inc., Alexandria, VA, USA

Strategies for Distance Learning Organizations Targeting Information Technology Professionals

Vucetic, Jelena; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the last decade, with rapid development and deployment of Internet-based applications, distance learning (DL) has emerged as a new paradigm in various aspects of education, including the academia, corporate training, certification programs as well as K-12 education. In this paper, we shall focus on the applicability of distance learning in the graduate education of information technology (IT) professionals.

Author

Organizations; Learning; Information Systems

20050203910 Ben Gurion Univ. of the Negev, Beersheva, Israel

Cooperative Human-Robot Learning System using a Virtual Reality Telerobotic Interface

Edan, Yael; Kartoun, Uri; Stern, Helman; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Abstract This paper presents the concept of a cooperative human-robot learning system for remote robotic operations using a virtual reality (VR) interface. The case-study task is to empty the contents of an unknown bag for subsequent scrutiny. The system employs several state-action policies. A system state is defined as a condition that exists in the system for a significant period of time and consists of the following sub-states: 1) the bag which includes a feature set such as its type (e.g., plastic bag, briefcase, backpack, or suitcase) and its condition (e.g., open, close, orientation, distortions in bag contour, partial hiding of a bag, changing of handle lengths); 2) the robot (e.g., gripper spatial coordinates, home position, idle, performing a task); 3) other objects (e.g., contents that fell out of the bag, obstructions) and 4) environmental conditions such as illumination (e.g., day or night). A system action takes the system to a new state. Action examples include initial grasping point, lift and shake trajectory, re-arranging the position of a bag to prepare it for better grasping and enable the system to verify if all the bag contents have been extracted. Given the system state and a set of actions, a policy is a set of state-action pairs to perform a robotic task. The system starts with knowledge of the individual operators of the robot arm, such as opening and closing the gripper, but it has no policy for deciding when these operators are not appropriate, nor does it have knowledge about the special properties of the bags. A policy is defined as the best action for a given state. The system learns this policy from experience and human guidance. A policy is found to be beneficial if a bag was grabbed successfully and all its contents have been extracted. The paper describes the overall system architecture and the virtual reality telerobotic system interface. Initial tests using on-line control through the VR interface for the task of shaking out the contents of a plastic bag are presented.

Author

Architecture (Computers); Robot Arms; Human Behavior; Telerobotics

20050203912 University Medicine Berlin, Berlin, Germany

Tools for Telementoring and Real-Time Telemedicine in Networks over Satellite

Graschew, Georgi; Rakowsky, Stefan; Roelofs, Theo A.; Schlag, Peter M.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 5 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

By the application of modern information technologies simulation, navigation and interactive communication have been realized for an improvement of medical diagnosis and therapy. Using a specially developed high-end software communication system (WinVicos) and respective hardware (WoTeSa) various telemedical applications like telementoring, teleconsultation and teleteaching have been enabled. Two telemedical networks have been developed recently: MEDASHIP (Medical Assistance for Ships) and EMISPHER (Euro-Mediterranean Internet-Satellite Platform for Health, medical Education and Research) for real-time services for healthcare. A high-immersive environment for training of surgical interventions is supported optimally by computer-assisted simulation and visualization and enables the surgeon to actively take part in the training and to work collaboratively.

Author

Telemedicine; Communication Equipment; Computer Techniques; Real Time Operation; Therapy; Medical Services; Medical Science; Diagnosis

20050203915 Aizu Univ., Fukuyama, Japan

Focused Crawling Japanese Scientific Documents

Cluev, V. V.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892

Contract(s)/Grant(s): zg-11; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

According to several estimations, the amount of data created in the last two years is as big as the accumulated data in all human history. This exponential growth trend continues. Finding appropriate information on the Web is getting more difficult with inefficient tools currently being used on the net. In this paper, we advocate a distributed topic specific (focused, niche, vertical) approach to build search engines. We discuss our experience in compiling a large Japanese document collection of Algorithms. We have found that some of our heuristics and techniques to crawl the Web have shown positive results.

Author

Heuristic Methods; Information Retrieval; World Wide Web; Accumulations; Searching

20050203916 Institute of Electrical and Electronics Engineers, Kaneshie, Ghana

E-commerce - E-Commerce Systems (ECS)

Asiedu, Timothy Kwadwo; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 19 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The essence of this paper is to explore the business and the technologies associated with E-commerce in a developing country like Ghana. In analyzing the usage of e-commerce in Ghana, a critical study of the target industries like Banks, Mining, Insurance, Courier, Internet Cafes, etc have been carried out. In considering the target industries, the category of users in those industries has also been looked at. Although E-commerce hasn't been with us for long, the rate at which it is being developed requires a study of its socio-economic impact in a developing country like Ghana. The paper further seeks to look at how E-commerce is impacting the Ghanaian market or how it could be used in Ghana and Africa as a whole to radically change and leapfrog the existing systems.

Author

Electronic Commerce; Developing Nations; Ghana; Internets

20050203925 Guelph Univ., Ontario, Canada

Building High Performance Main Memory Web Databases

Wang, Fangju; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 22 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Databases play an increasingly important role in Web applications. Currently, most Web databases are disk resident databases (DRDBs). Web DRDBs have high costs in database connection and data retrieval. So far, in improving Web server performance, reduction of database I/O costs have not been paid deserved attention because network data transmission costs has been the dominant ones. With the development of high-speed networks, data transmission costs have been largely reduced and thus database costs have accounted for larger and larger proportion in Web site response time. The technology of main memory database (MMDBs) may help reduce database costs and thus improve Web server performance. In this research, we developed two techniques for building high performance Web MMDBs. Experiments using real data on the Internet showed that the two MMDB techniques may significantly improve Web sites performance at the current network speeds.

Author

Data Bases; Memory (Computers); Websites; Computer Systems Performance

20050203953 Molde Coll., Molde, Norway

Broadband Infrastructure and Rural Regional Development in the County of More and Romsdal, Norway

Molka-Danielsen, Judith; Ohren, Ottar; Jaeger, Bjorn; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reports on findings of two surveys conducted in April 2001 and November 2002 on broadband infrastructure deployment and utilization of ICT services in 38 local governments of one county in Norway. Services include internal administrative services for the employees and services to the residents of the communities. We examine how well actual adoption of services had met with expectations. Findings show adoption and use was not as pervasive as expected. Our study is compared to several other regional area studies carried out in Spain. Last, we discuss how this can be an inhibitor to this area's regional economic development.

Author

Broadband; Norway; Rural Areas; Regions; Communication Networks

63

CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 *Man/System Technology and Life Support*.

20050200728 Naval Research Lab., Washington, DC USA

Achieving Collaborative Interaction with a Humanoid Robot

Sofge, D.; Perzanowski, Dennis; Skubic, M.; Cassimatis, N.; Trafton, J. G.; Brock, D.; Bugajska, Magda; Adams, William; Schultz, Alan C.; Jan. 2003; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A434972; XB-NRL/MR/5510; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the great challenges of putting humanoid robots into space is developing cognitive capabilities for the robots with an interface that allows human astronauts to collaborate with the robots as naturally and efficiently as they would with other astronauts. In this joint effort with NASA and the entire Robonaut team we are integrating natural language and gesture understanding, spatial reasoning incorporating such features as human-robot perspective taking, and cognitive model-based understanding to achieve this high level of human-robot interaction.

DTIC

Robots; Human Beings

20050201065 Naval Command, Control and Ocean Surveillance Center, San Diego, CA USA

Development and Command-Control Tools for Many-Robot Systems

Gage, Douglas W.; Jan. 2005; 10 pp.; In English

Report No.(s): AD-A435840; No Copyright; Avail: Defense Technical Information Center (DTIC)

An initial concept is presented for a set of communications and command-control capabilities that can facilitate the development process for a system consisting of an arbitrarily large number of relatively simple (and probably small and inexpensive, although not necessarily 'micro') robots -- mechanisms to allow the human developer to quickly and easily see into the internal state of large numbers of robots, and to quickly and easily make changes to the robots' behaviors. The interface between the control station and the developer must be carefully designed in order to provide a serviceable

development environment, and this environment, or subsets of it, should then evolve into the operator's station for deployed systems that require active control and monitoring. The development environment must provide the developer with a precise model for (re-) programming the elements of the system, while the system operator will require only the simplest functional model of the system as a whole that can support mission needs, combined with a convenient way to tell the system what to do.

DTIC

Command and Control; Robots

20050202019 Houston Univ., TX, USA

Design and Performance Evaluation of a UWB Communication and Tracking System for Mini-AERCam

Barton, Richard J.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 2-1 - 2-20; In English; See also 20050202011

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

NASA Johnson Space Center (JSC) is developing a low-volume, low-mass, robotic free-flying camera known as Mini-AERCam (Autonomous Extra-vehicular Robotic Camera) to assist the International Space Station (ISS) operations. Mini-AERCam is designed to provide astronauts and ground control real-time video for camera views of ISS. The system will assist ISS crewmembers and ground personnel to monitor ongoing operations and perform visual inspections of exterior ISS components without requiring extravehicular activity (EAV). Mini-AERCam consists of a great number of subsystems. Many institutions and companies have been involved in the R&D for this project. A Mini-AERCam ground control system has been studied at Texas A&M University [3]. The path planning and control algorithms that direct the motions of Mini-AERCam have been developed through the joint effort of Carnegie Mellon University and the Texas Robotics and Automation Center [5]. NASA JSC has designed a layered control architecture that integrates all functions of Mini-AERCam [8]. The research described in this report is part of a larger effort focused on the communication and tracking subsystem that is designed to perform three major tasks: 1. To transmit commands from ISS to Mini-AERCam for control of robotic camera motions (downlink); 2. To transmit real-time video from Mini-AERCam to ISS for inspections (uplink); 3. To track the position of Mini-AERCam for precise motion control. The ISS propagation environment is unique due to the nature of the ISS structure and multiple RF interference sources [9]. The ISS is composed of various truss segments, solar panels, thermal radiator panels, and modules for laboratories and crew accommodations. A tracking system supplemental to GPS is desirable both to improve accuracy and to eliminate the structural blockage due to the close proximity of the ISS which could at times limit the number of GPS satellites accessible to the Mini-AERCam. Ideally, the tracking system will be a passive component of the communication system which will need to operate in a time-varying multipath environment created as the robot camera moves over the ISS structure. In addition, due to many interference sources located on the ISS, SSO, LEO satellites and ground-based transmitters, selecting a frequency for the ISS and Mini-AERCam link which will coexist with all interferers poses a major design challenge. To meet all of these challenges, ultrawideband (UWB) radio technology is being studied for use in the Mini-AERCam communication and tracking subsystem. The research described in this report is focused on design and evaluation of passive tracking system algorithms based on UWB radio transmissions from mini-AERCam.

Author

Cameras; Robotics; Robot Dynamics; International Space Station; Multipath Transmission; Extravehicular Activity

20050203847 Cuyahoga Community Coll., Cleveland, OH, USA

Youth Technology Academy

[2005]; 3 pp.; In English

Contract(s)/Grant(s): NNC05GA17G; No Copyright; Avail: CASI; [A01](#), Hardcopy

One of the most important aspects of the YTA Program is that students, working with Tri-C instructors, NASA engineers, and technicians, begin to build relationships with professionals with whom they might not normally have contact. These professionals serve as role models for students and help them to apply math, science and problem-solving skills in real time to construct a competition-ready robot, allowing them to experience the satisfaction and challenges of an engineering or technical career by working diligently to solve problems that may never have been thought possible to solve. Transcending school boundaries, YTA is available to all students who are interested and qualified but who may otherwise never get an opportunity to participate because their school does not offer a robotics program. YTA fills an educational void by offering an exciting engineering and technology experience to a greater number of students than have been able to participate in the past. Our students have been working hard and see the long-term rewards for their efforts. The YTA Team 1270 was a finalist at the 2005 FIRST Robotics Florida Regional and took home second- place honors. Mark Poljak, nominated by the students of YTA Team 1270, received the Woodie Flowers Award at the FIRST 2005 Buckeye Regional competition. This award

celebrates effective communication in the art and science of engineering and design. The YTA Team was also invited, as one of fifty-four teams, to participate in this year's FIRST VEX Robotics tournament representing Cuyahoga Community College and NASA GRC (Team 26), held at the FIRST Robotics National Competition in Atlanta, GA. Because of our efforts, community colleges from around the country have taken notice and have asked us to become part of the executive board of the RoboEducators, whose mission is to bring technology training to high school students in preparation for the future workforce.

Derived from text

Education; Students; Real Time Operation; Robotics; Problem Solving; Engineers

20050203901 Maribor Univ., Maribor, Slovenia

Web Based Education of Robotics and Mechatronics at the University of Maribor

Terbuc, Martin; Uran, Suzana; Rojko, Andreja; Jezernik, Karel; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 9 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Rapid development of informatics technology has brought new ways to the teaching process. Book and personal contacts are supplemented with electronic documents with moving pictures and Internet connections. So we have access from anywhere, anytime and from any computer system. The content can be changed simultaneously. We introduce new media to the study of electrical automation. Internet and World Wide Web are new means in the teaching. The teaching approach, which is practiced at Institute of robotics for last few years, is presented. It is shown how the teaching material is prepared, how the homeworks are issued and the students training for lab work and projects are presented. Using contemporary methods they get used of up-to-date technology, which will be used in their profession. The teaching means based on the new technology will not replace the traditional way of teaching. However, it will supplement it and improve significantly.

Author

Education; Robotics; World Wide Web; Technologies

64

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20050200836 George Washington Univ., Washington, DC USA

Design Tools for Zero Net Mass flux Devices: CFD Effort

Mittal, Rajat; May 2005; 33 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0146

Report No.(s): AD-A435338; AFRL-SR-AR-TR-05-0256; No Copyright; Avail: CASI; [A03](#), Hardcopy

Numerical simulations have been used to examine the fluid dynamics of zero-net mass flux devices. The emphasis is on extracting insights that can be used in developing simple models of these actuators for use in separation control. The unsteady evolution of a transitional synthetic jet in the absence of cross-flow is investigated by time-accurate three-dimensional direct numerical simulations of incompressible Navier-Stokes equations and the results compared with one of the test cases designated for the NASA CFD Validation of Synthetic Jets and Turbulent Separation Control. The validated results are then used for a comprehensive analysis of the flow inside the cavity and the jet slot. The flux of vorticity from these devices is considered to be an important factor in the control of separated flow and in the current study, we have used numerical simulations to extract scaling laws for this quantity. A theoretical model is also proposed for determining the pressure losses in ZNMF slots and orifices and numerical simulations used to determine the scaling of some of the key parameters in this theoretical model.

DTIC

Computational Fluid Dynamics; Mathematical Models

20050200864 Brigham and Women's Hospital, Boston, MA USA

Development and Validation of a Computational Model for Intra-Cellular Circadian Oscillators

Weaver, David R.; May 2005; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0554; DARPA ORDER M300; Proj-BIOC

Report No.(s): AD-A435444; AFRL-IF-RS-TR-2005-203; No Copyright; Avail: Defense Technical Information Center (DTIC)

Circadian rhythms are endogenous rhythms in physiology or behavior with a cycle length near 24 hours. Circadian rhythms are relevant to military activities because the ability of military personnel to maintain high level of cognitive performance and vigilance for long intervals is degraded by human factors, including fatigue, sleep loss and other circadian factors. Underlying circadian rhythmicity is a molecular feedback loop. This project developed mathematical models of the mammalian circadian oscillator. Our approach was to gather information on parameters needed for model development through biochemical experiments, develop mathematical models of the mammalian circadian oscillator, and experimentally test predictions from these models. We created a reduced molecular model, with the long-term objective of incorporating a molecular model into an existing model of the influence of light and rhythmicity on human performance. Our experimental and modeling efforts led to several publications and the contribution of software for numerous circadian models to BioSpice. Understanding of the circadian oscillatory mechanism has the potential for new strategies in resetting the circadian clock to promote alertness and to enhance physiological synchronization to new environments after transmeridian travel. Our development of detailed molecular models of the mammalian clock provides an important first step towards these objectives.

DTIC

Circadian Rhythms; Computer Programs; Mathematical Models; Military Operations; Models; Oscillators

20050200907 Naval Postgraduate School, Monterey, CA USA

Constant and Power-of-2 Segmentation Algorithms for a High Speed Numerical Function Generator

Valenzuela, Zaldy M.; Jun. 2005; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435543; No Copyright; Avail: Defense Technical Information Center (DTIC)

The realization of high-speed numeric computation is a sought-after commodity for real world applications, including high-speed scientific computation, digital signal processing, and embedded computers. An example of this is the generation of elementary functions, such as $\sin(x)$, e^x and $\log(x)$. Sasao, Butler and Reidel Ref. 1 developed a high speed numeric function generator using a look-up table (LUT) cascade. Their method used a piecewise linear segmentation algorithm to generate the functions Ref. 1. In this thesis, two alternative segmentation algorithms are proposed and compared to the results of Sasao, Butler and Reidel Ref.1. The first algorithm is the Constant Approximation. This algorithm uses lines of slope zero to approximate a curve. The second algorithm is the power-of-2-approximation. This method uses $2^i x$ to approximate a curve. The constant approximation eliminates the need for a multiplier and adder, while the power-of-2-approximations eliminates the need for multiplier, thus improving the computation speed. Tradeoffs between the three methods are examined. Specifically, the implementation of the piecewise linear algorithm requires the most amount of hardware and is slower than the other two. The advantage that it has is that it yields the least amount of segments to generate a function. The constant approximation requires the most amount of hardware to realize a function, but is the fastest implementation. The power-of-2 approximation is an intermediate choice that balances speed and hardware requirements.

DTIC

Algorithms; Function Generators; High Speed; Numerical Analysis; Segments

20050200930 Naval Postgraduate School, Monterey, CA USA

A Time Series Analysis of U.S. Army Officer Loss Rates

Sparling, Steven J.; Jun. 2005; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435582; No Copyright; Avail: Defense Technical Information Center (DTIC)

Accurate prediction of officer loss behavior is essential for the planning of personnel policies and executing the U.S. Army's Officer Personnel Management System (OPMS). Inaccurate predictions of officer strength affect the number of personnel authorizations, the Army's budget, and the necessary number of accessions. Imbalances of officer strength in the basic branches affect the Army's combat readiness as a whole. Captains and majors comprise a critical management population in the USA Army's officer corps. This thesis analyzes U.S. Army officer loss rates for captains and majors and evaluates the fit of several time series models. The results from this thesis validate the time series forecasting technique currently used by the Army G-1, Winters-method additive.

DTIC

Losses; Military Personnel; Personnel; Time Series Analysis

20050200977 Naval Postgraduate School, Monterey, CA USA

Performance Metrics for the Program Executive Office for Integrated Warfare Systems 1.0 and 2.0

Arnold, Ronald J.; Jun. 2005; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435668; No Copyright; Avail: Defense Technical Information Center (DTIC)

There is an obvious need for performance measurement in U. S. Navy commands. Not only are performance metrics, or measurements, essential to tracking progress toward strategic goals, but as a publicly funded entity and holder of the public trust, the Navy has an obligation to efficiently and effectively use those public funds. Performance metrics are the guideposts to achieving efficiency and effectiveness. This thesis was designed to aid the Program Executive Office for Integrated Warfare Systems, a Navy Echelon III acquisition command, with a performance measurement project, deriving metrics for two of its seven major programs, IWS 1.0 and 2.0. Performance drivers were captured through interviews with key leaders in those two major programs. Those interviews were transformed into causal performance maps which depicted the interplay of the drivers and the outcomes they influenced. Performance metrics were then derived for those drivers and outcomes and arranged in a balanced scorecard format. The scorecards will hopefully be useful to the major program managers in monitoring the progress of their organizations toward achieving strategic success. Additionally, the metrics should enhance understanding of strategic direction by the rank and file of IWS 1.0 and 2.0.

DTIC

International System of Units; Systems Integration; Warfare

20050200993 Yale Univ., New Haven, CT USA

A New Foundation for ATR

Zucker, Steven W.; Huggins, Patrick; ben Shahar, Ohad; Li, Gang; Nov. 2004; 6 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0153

Report No.(s): AD-A435709; AFRL-SR-AR-TR-05-0260; No Copyright; Avail: CASI; [A02](#), Hardcopy

Objectives: To develop computer vision algorithms based on biological, mathematical, and computational principles that are relevant to automatic target recognition, especially as this pertains to the Air Force. Status of Effort: The effort proceeded actively for three years, with progress as summarized below. Researchers at Wright-Patterson Air Force Base have become interested in the material, and have done internal experiments to check its applicability to ATR. Unfortunately funding for the project has terminated precisely when transitions are ready to take place.

DTIC

Algorithms; Computer Vision; Target Recognition

20050201096 Army Construction Engineering Research Lab., Champaign, IL USA

SPiRiT Scoring Through Self-Assessment Charrettes

Schneider, Richard; Fournier, Donald F.; Sep. 2004; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435914; ERDC/CERL-TR-04-19; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Sustainable Project Rating Tool (SPiRiT) was developed by the US Army Engineer Research and Development Center (ERDC) as a measurement system for rating new and major renovations to institutional buildings. SPiRiT evaluates environmental performance from a whole building perspective over a building's life cycle and provides a definitive standard to assess the sustain-ability or 'green' attributes of the design-construct process for a given project. SPiRiT addresses critical areas of the design-construct process for seven categories or issues: site, water, energy usage, materials, indoor environmental quality, facility delivery, and current mission. The rating system consists of prerequisites and credits that when met provide points towards an overall score. The overall score is used to indicate one of four project certification levels-Bronze, Silver, Gold, and Platinum, indicating increasing levels of sustainability or 'greenness.' All Army Military Construction projects and major OMA projects must achieve a Bronze rating level. This guide provides an informational guide for installation Directorate of Public Works (DPW) and U.S. Army Corps of Engineer District Engineer staffs in conducting self-assessment charrettes to score projects designed to meet SPiRiT requirements.

DTIC

Ratings; Scoring

20050202015 College of the Mainland, Texas City, TX, USA

Monte Carlo Simulation of Markov, Semi-Markov, and Generalized Semi- Markov Processes in Probabilistic Risk Assessment

English, Thomas; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 6-1 - 6-15; In English; See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; No Copyright; Avail: CASI; [A03](#), Hardcopy

A standard tool of reliability analysis used at NASA-JSC is the event tree. An event tree is simply a probability tree, with the probabilities determining the next step through the tree specified at each node. The nodal probabilities are determined by

a reliability study of the physical system at work for a particular node. The reliability study performed at a node is typically referred to as a fault tree analysis, with the potential of a fault tree existing for each node on the event tree. When examining an event tree it is obvious why the event tree/fault tree approach has been adopted. Typical event trees are quite complex in nature, and the event tree/fault tree approach provides a systematic and organized approach to reliability analysis. The purpose of this study was two fold. Firstly, we wanted to explore the possibility that a semi-Markov process can create dependencies between sojourn times (the times it takes to transition from one state to the next) that can decrease the uncertainty when estimating time to failures. Using a generalized semi-Markov model, we studied a four element reliability model and were able to demonstrate such sojourn time dependencies. Secondly, we wanted to study the use of semi-Markov processes to introduce a time variable into the event tree diagrams that are commonly developed in PRA (Probabilistic Risk Assessment) analyses. Event tree end states which change with time are more representative of failure scenarios than are the usual static probability-derived end states.

Author

Markov Processes; Reliability Analysis; Risk; Monte Carlo Method

20050202078 NASA Glenn Research Center, Cleveland, OH, USA

Linear-Quadratic-Gaussian Regulator Developed for a Magnetic Bearing

Choi, Benjamin B.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Linear-Quadratic-Gaussian (LQG) control is a modern state-space technique for designing optimal dynamic regulators. It enables us to trade off regulation performance and control effort, and to take into account process and measurement noise. The Structural Mechanics and Dynamics Branch at the NASA Glenn Research Center has developed an LQG control for a fault-tolerant magnetic bearing suspension rig to optimize system performance and to reduce the sensor and processing noise. The LQG regulator consists of an optimal state-feedback gain and a Kalman state estimator. The first design step is to seek a state-feedback law that minimizes the cost function of regulation performance, which is measured by a quadratic performance criterion with user-specified weighting matrices, and to define the tradeoff between regulation performance and control effort. The next design step is to derive a state estimator using a Kalman filter because the optimal state feedback cannot be implemented without full state measurement. Since the Kalman filter is an optimal estimator when dealing with Gaussian white noise, it minimizes the asymptotic covariance of the estimation error.

Derived from text

Magnetic Bearings; Linear Quadratic Gaussian Control; Linear Quadratic Regulator; Normal Density Functions

20050202080 NASA Glenn Research Center, Cleveland, OH, USA

Finite Element Analysis of Morphing Piezoelectric Structures Studied

Lee, Ho-Jun; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The development of morphing aerospace structures that optimize their shape offers the potential to significantly improve the performance of existing airplanes. These morphing vehicles will operate with new capabilities to reduce noise, damp vibrations, manipulate flow, and monitor damage. Piezoelectric materials represent one of the popular materials currently being investigated for applications in morphing structures.

Derived from text

Finite Element Method; Piezoelectricity; Structural Analysis

20050202082 NASA Glenn Research Center, Cleveland, OH, USA

Neural Network and Regression Soft Model Extended for PAX-300 Aircraft Engine

Patnaik, Surya N.; Hopkins, Dale A.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

In fiscal year 2001, the neural network and regression capabilities of NASA Glenn Research Center's COMETBOARDS design optimization testbed were extended to generate approximate models for the PAX-300 aircraft engine. The analytical model of the engine is defined through nine variables: the fan efficiency factor, the low pressure of the compressor, the high pressure of the compressor, the high pressure of the turbine, the low pressure of the turbine, the operating pressure, and three critical temperatures ($T_{\text{sub } 4}$, $T_{\text{sub vane}}$, and $T_{\text{sub metal}}$). Numerical Propulsion System Simulation (NPSS) calculations of the specific fuel consumption (TSFC), as a function of the variables can become time consuming, and numerical instabilities can occur during these design calculations. 'Soft' models can alleviate both deficiencies. These approximate models are generated from a set of high-fidelity input-output pairs obtained from the NPSS code and a design of the experiment strategy.

A neural network and a regression model with 45 weight factors were trained for the input/output pairs. Then, the trained models were validated through a comparison with the original NPSS code. Comparisons of TSFC versus the operating pressure and of TSFC versus the three temperatures ($T(\text{sub } 4)$, $T(\text{sub vane})$, and $T(\text{sub metal})$) are depicted in the figures. The overall performance was satisfactory for both the regression and the neural network model. The regression model required fewer calculations than the neural network model, and it produced marginally superior results. Training the approximate methods is time consuming. Once trained, the approximate methods generated the solution with only a trivial computational effort, reducing the solution time from hours to less than a minute.

Derived from text

Neural Nets; Design Optimization; Experiment Design; Mathematical Models; Engine Design

20050203821 Indonesia Univ., Jakarta, Indonesia

Performance of Parallel Iterative Solution of Linear Systems Using GMRES

Kartawidjaja, M. A.; Suhartanto, H.; Basaruddin, T.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 8 pp.; In English; See also 20050203815; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Abstract Applications involving large nonsymmetric linear systems encourage parallel implementation of robust iterative solution methods, such as GMRES. We describe the parallelization of GMRES using modified Gram-Schmidt method in the orthogonal phase and implement it on a cluster of PCs under the PVM message-passing environment. For the test problems we use two kind of matrix structures, full and two blocks diagonal matrices. A theoretical model of the computational work and communication is presented and the performance is analyzed. The result of our experiment indicates an acceptable performance, especially when the input size is sufficiently large. By using four processors the speedup can reach up to 2.64 for full matrix and 2.83 for two blocks diagonal matrix. In addition, our observation indicates that our theoretical model fits satisfactorily with the experimental result, and thus our model can be considered useful for extrapolating performance with the increasing data size and the number of processors.

Author

Iterative Solution; Mathematical Models; Linear Systems

20050203856 NASA Stennis Space Center, Stennis Space Center, MS, USA

Computational Modeling of Liquid and Gaseous Control Valves

Daines, Russell; Ahuja, Vineet; Hosangadi, Ashvin; Shipman, Jeremy; Moore, Arden; Sulyma, Peter; [2005]; 11 pp.; In English; 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NNS04AB67T

Report No.(s): AIAA Paper 2005-4543; NASA/NP-2005-07-00065-SSC; Copyright; Avail: CASI; [A03](#), Hardcopy

In this paper computational modeling efforts undertaken at NASA Stennis Space Center in support of rocket engine component testing are discussed. Such analyses include structurally complex cryogenic liquid valves and gas valves operating at high pressures and flow rates. Basic modeling and initial successes are documented, and other issues that make valve modeling at SSC somewhat unique are also addressed. These include transient behavior, valve stall, and the determination of flow patterns in LOX valves. Hexahedral structured grids are used for valves that can be simplified through the use of axisymmetric approximation. Hybrid unstructured methodology is used for structurally complex valves that have disparate length scales and complex flow paths that include strong swirl, local recirculation zones/secondary flow effects. Hexahedral (structured), unstructured, and hybrid meshes are compared for accuracy and computational efficiency. Accuracy is determined using verification and validation techniques.

Author

Control Valves; Flow Distribution; Flow Velocity; Cryogenics; Secondary Flow; Rocket Engines

20050203880 NASA Glenn Research Center, Cleveland, OH, USA

High-Fidelity Micromechanics Model Developed for the Response of Multiphase Materials

Aboudi, Jacob; Pindera, Marek-Jerzy; Arnold, Steven M.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A new high-fidelity micromechanics model has been developed under funding from the NASA Glenn Research Center for predicting the response of multiphase materials with arbitrary periodic microstructures. The model's analytical framework is based on the homogenization technique, but the method of solution for the local displacement and stress fields borrows

concepts previously employed in constructing the higher order theory for functionally graded materials. The resulting closed-form macroscopic and microscopic constitutive equations, valid for both uniaxial and multiaxial loading of periodic materials with elastic and inelastic constitutive phases, can be incorporated into a structural analysis computer code. Consequently, this model now provides an alternative, accurate method.

Derived from text

Computer Programs; Macroscopic Equations; Micromechanics; Microstructure; Structural Analysis

20050203933 Australian National Univ., Canberra, Australia

Mapping, Programmability and Scalability of Problems for Quantum Speed-up

Krishnamurthy, E. V.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper explores the reasons as to why the quantum paradigm is not so easy to extend to all of the classical computational algorithms. We also explain the failure of programmability, and scalability in quantum speed-up . Also due to the presence of quantum entropy, quantum algorithm cannot obviate the curse of dimensionality encountered in solving many complex numerical and optimization problems.

Author

Algorithms; Entropy; Failure; Quantum Computation

20050203941 Texas Univ., Arlington, TX, USA

A Collaborative Project for Developing Smart Residences for Aging Populations; Health Monitoring in an Agent-based Smart Home

Eve, Raymond A.; Cook, Diane J.; Das, Sajal; Gopalratnam, Karthik; Roy, Abhishek; Eve, Susan Brown; Durand, Kenneth; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 26 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes a project where the goal is to assist the elderly and individuals with disabilities by providing home capabilities that will monitor health trends and assist in the inhabitant's day to day activities in their own homes. The results will save money for the individuals, their families, and the state. We are seeking to meet this goal using the MavHome smart home environment located at the University of Texas at Arlington. The MavHome is equipped with sensors that record inhabitant interactions with many different devices, medicine-taking schedules, movement patterns, and vital signs. We are now developing algorithms that learn patterns of activities from this data. We will apply these capabilities to health monitoring and independent living for aged and disabled persons.

Author

Age Factor; Algorithms; Health

20050203943 Purdue Univ., West Lafayette, IN, USA

Network Adaptability in Clusters and Grids

Evans, Jeffrey J.; Baik, Seongbok; Kroculik, Joseph; Hood, Cynthia S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 8 pp.; In English; See also 20050203892; Original contains black and white illustrations

Contract(s)/Grant(s): W-31-eng-38; NSF 99-84811; NSF 03-25378; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The acceleration in computational scale to solve problems in emerging 'computational' fields from Nanoscience and Genetics to Astrophysics places increasingly heavy compute and data storage burdens on locally and globally distributed computer systems. We are focusing on the management of these loosely coupled systems (clusters and Grids) which are asked to behave as an increasingly large single entity, repeatably and reliably. Our approach explores several areas and levels, from low level detection and reaction of loosely coupled subsystems to application dynamics, including human factors. These areas are discussed and results from our work to date is presented. New questions emerge to stimulate deeper thought and discussion of requirements understanding and capture.

Author

Adaptation; Network Analysis; Cluster Analysis; Grid Generation (Mathematics)

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20050200868 Naval Postgraduate School, Monterey, CA USA

An Analysis of Hispanic Midshipmen Success at the USA Naval Academy

Alsina, Francisco J.; Jun. 2005; 139 pp.; In English

Report No.(s): AD-A435453; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research studies the success of Hispanic midshipmen at the Naval Academy. Specifically, graduation, senior leadership positions during first class (senior) year, military performance grades, and cumulative academic Quality Point Rating (college GPA) are examined as the measures of success. A host of pre entry variables are used to control any affect they might have that would otherwise be confounded with midshipmen's ethnic, racial, or gender identification. Midshipmen from the classes of 1999 to 2004 compose the dataset for regression analysis. Hispanic midshipmen cannot be studied in a vacuum, and therefore, this research generates information on a number of different groups. But, the performance of Hispanic midshipmen at the Naval Academy is of primary focus throughout. Of the four measures of success, this study shows that Hispanic midshipmen are likely to have a lower cumulative academic QPR; but, are proportionately represented in terms of graduation, senior leadership positions, and military performance grades.

DTIC

Regression Analysis; United States

20050200922 Naval Postgraduate School, Monterey, CA USA

A First Step Towards Zero Down Time: The Creation of Synergy Through Equipment Acquisition within the Constraints of a Small Budget in an Army with Civilian Oversight - A Case of the Botswana Defence Force (BDF)

Mompati, Mothusi G.; Jun. 2005; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435570; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis seeks to explore the satisfaction levels for variables that should be considered when procuring equipment in the BDF. It is believed that this investigation should lead to a statistical model specific to the BDF's procurement methods. New methods of acquisition are now demanded by the PPADB; hence new metrics have to be applied to strike an accord with the new requirements of buying for government. The null hypothesis, H_0 , for this thesis is that: Downtime or turnaround time (TAT) cannot be reduced by favorable independent variables. This follows from the preliminary conclusion that there is substantial downtime as at present. It postulates that something can be done to ameliorate past mishaps. The null hypothesis therefore assumes that this will continue to prevail no matter what is done. The alternative hypothesis, H_a , is that: TAT can be reduced by favorable independent variables. The results show substantial dissatisfaction with the procurement methods of the BDF. Further research is recommended in the light of the weakness of the resultant regression model, which gave $R^2 = 29\%$.

DTIC

Botswana; Maintainability

20050201002 Air Force Research Lab., Edwards AFB, CA USA

A Monte Carlo Radiation Model for Simulating Rarefied Multiphase Plume Flows

Burt, Jonathan; Boyd, Iain; May 2005; 15 pp.; In English

Contract(s)/Grant(s): Proj-5503

Report No.(s): AD-A435725; No Copyright; Avail: Defense Technical Information Center (DTIC)

A Monte Carlo ray trace radiation model is presented for the determination of radiative properties of Al_2O_3 particles in the high altitude plume of a solid propellant rocket. A polydisperse distribution of non-gray particles is modeled as an emitting, absorbing and scattering medium of arbitrary optical thickness. Strong two-way coupling is allowed between radiation and flowfield calculations, where the gas is simulated using the direct simulation Monte Carlo method and particle phase properties are determined using a similar Lagrangian approach. Effects of anisotropic scattering and nozzle searchlight emission are considered, and a procedure is described for the calculation of spectral radiance. The model is applied to the simulation and radiation analysis of the freely expanding plume from a subscale solid rocket motor, and various flowfield properties are presented and discussed.

DTIC

Anisotropy; Models; Monte Carlo Method; Multiphase Flow; Plumes; Rarefied Gas Dynamics; Rarefied Gases; Simulation

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20050200982 Naval Postgraduate School, Monterey, CA USA

The Use of System Dynamics Analysis and Modeling Techniques to Explore Policy Levers in the Fight Against Middle Eastern Terrorist Groups

Alcantara Gil, Benigno R.; Matsuura, Masahiro; Monzon, Carlos M.; Samothrakakis, Ioannis; Jun. 2005; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435682; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this project is to use analysis and modeling techniques from Systems Dynamics to capture the causal relationships of Middle Eastern groups' terrorist activities against the USA based on their ideological drivers, as well as the effect of U.S. policies that create dynamics and affect performance and outcomes. The main focus of the analysis is the terrorist groups' human resources. The hypothesis is that Middle Eastern terrorism against the USA is affected by the U.S. level of military presence and/or investment in the Middle Eastern nations. A considerable and lasting reduction in fatalities originated by Middle Eastern groups' terrorist attacks against the USA can be achieved through a policy that reduces both the human resources available to terrorist groups and their attack capability (level of sophistication). The study covers the implications of this resource reduction policy, which may include incremental military investment, defection motivators, anti-terrorism, and the use of counterterrorism operations. These operations will reduce the sophistication as well as the recruitment rate to levels where the functionality of terrorist cells will be impaired, and thus unable to carry out high lethality attacks.

DTIC

Human Resources; Levers; Middle East; Policies; Systems Analysis; Threat Evaluation; United States

20050201079 L-3 Communications Analytics Corp., Vienna, VA USA

Effects Based Operations Wargaming Simulation (EBOWS)

Plotz, Gary A.; Jun. 2005; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-C-0055; Proj-EBO0

Report No.(s): AD-A435864; AFRL-IF-RS-TN-2005-3; No Copyright; Avail: Defense Technical Information Center (DTIC)

The complexities of 21st century warfare have emphasized a need for skilled analysts in the Air and Space Operations Center (AOC) and, by extension, the tools to support them. In response to this, the Air Force Studies and Analysis Agency (AFSAA) has launched 'The Analyst in the AOC Initiative' to 'Deploy Operations Research Expertise to Support the War Fighter.' Similarly, Air Force Research Laboratories (AFRL), Rome NY, initiated an Advanced Technology Demonstration to develop new capabilities for implementing Effects-Based Operations (EBO) Planning, Execution, and Assessment, with the long-term vision of fielding a 'Dynamic Tasking Toolkit that Supports EBO' in the AOC. EBOWS is the wargaming component of this toolkit. Its role is to assess the relative merits of competing Courses of Action (COA) within an operational context and provide the Campaign Planner with results that are detailed and accurate enough to support decision-making. EBOWS models significant aspects of Aerospace, Land, and Naval warfare. It not only provides campaign planners with insights into the impact of their decisions upon future operations, it does so with sufficient detail for analysts to trace unexpected results back to a root cause.

DTIC

Military Operations; Operations Research; Simulation; War Games

20050201605 Military Academy, West Point, NY USA

A Capabilities Based Measure of Readiness

Kaczynski, Bill; Foote, Bobbie L.; Henderson, Steve; Pohl, Edward A.; Jun. 2005; 28 pp.; In English

Contract(s)/Grant(s): Proj-DSE-R-0522

Report No.(s): AD-A434782; DSE-TR-0522; No Copyright; Avail: CASI; A03, Hardcopy

In this paper written to satisfy the requirements of the Barchii prize nomination, problems with the readiness metric of The USA Army are explored and a solution devised. This metric allows a clearer picture of the current mission capability of a unit and provides guidelines for ordering parts and sub-systems. Field interviews with helicopter pilots, mechanics, and leaders documented the problem in the field. Congressional testimony was used to show that new metrics are needed and

should be based on a definition of capability. This metric is general and can apply at the micro level (tank, helicopter, etc) or macro level (brigade, division and up).

DTIC

Inventory Controls; Maintainability; Replenishment

20050203895 Information Assets, Inc., Houston, TX, USA

Managing Contribution

Beazley, William G.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 25 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Successful companies spend countless hours tuning and re-tuning themselves to enhance contributions to customer delivery and earning value for their shareholders. They manage contribution rather than execution. This paper will discuss a new approach to performance analysis and management based on contribution. Contribution is not execution. Simply put, contribution is the value added to an expected opportunity to deliver products and services. The approach uses 'contribution analysis' to link individual activities to ultimate value delivery and manage local performance to maximize delivered value. In 2003, I introduced the idea of contribution analysis as a tool to relate the contribution of one contributor to one value delivery. This technique leads to local metrics that would encourage each individual

Derived from text

Reliability Analysis; Performance Prediction; Delivery

20050203930 University of Central Queensland, Rockhampton, Australia

A New Approach to Analyze Huge Internet and Telecommunications Data

Korotkikh, Victor; Patson, Noel; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 6 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Large data sets associated with telecommunications and cyberspace systems can be viewed as digraphs with hundreds of millions of vertices [1]-[3]. These huge graphs are cumbersome to process and difficult to visualize due to the size of computer displays that are usually of the order of only one million vertices [1], [2]. In this paper an approach is explored that represents digraphs as 2-D vectors that interact to form a Lipschitz function which is a 3-D surface. These surfaces can be efficiently encoded as binary sequences [4]-[8] and thus reduce the amount of memory required to visualize the 'terrain' of a digraph and still retain the geographical nature of the data. Index Terms Data Visualization, Data Mining, Digraphs, Massive Databases, Internet, Telecommunications.

Author

Data Mining; Telecommunication; Internets; Data Bases; Scientific Visualization

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20050200975 New Jersey Inst. of Tech., Newark, NJ USA

Robust Lossless Image Data Hiding

Shi, Yun Q.; May 2005; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-1-0264; Proj-STG3

Report No.(s): AD-A435666; AFRL-IF-RS-TR-2005-209; No Copyright; Avail: Defense Technical Information Center (DTIC)

Two novel robust lossless data hiding algorithms that do not use modulo-256 to achieve losslessness and hence do not generate salt-and-pepper noise have been invented and developed in this project. One is implemented in spatial domain, another in integer wavelet transform domain. Both are based on patchwork theory and both treat blocks of different content with different embedding schemes. Permutation and error correction codes are utilized to enhance robustness. Extensive experimental works have been conducted and have demonstrated the effectiveness of these two algorithms. These two algorithms have been used in a Unified Authentication Framework for JPEG2000 Images, which has now been included in

the final committee draft (FCD) 1.0 of the Security Part of JPEG2000 (JPSEC) standard.

DTIC

Embedding; Wavelet Analysis

20050201031 Rutgers - The State Univ., New Brunswick, NJ USA

Control of Nonlinear Systems

Sontag, Eduardo D.; Jan. 2004; 5 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0172; Proj-2304

Report No.(s): AD-A435775; AFRL-SR-AR-TR-05-0271; No Copyright; Avail: CASI; [A01](#), Hardcopy

This Final Report summarizes accomplishments of the grant research. The work focuses on the mathematical foundations of nonlinear systems analysis and feedback control. The emphasis is on monotone input/output systems, and underlying new theoretical questions arising from the study of biomolecular cellular mechanisms, seen as a source of inspiration for novel sensor, actuation, and control architectures.

DTIC

Nonlinear Systems; Nonlinearity

20050201109 California Univ., Berkeley, CA USA

Seismic Imaging of UXO-Contaminated Underwater Sites

Gritto, Roland; Korneev, Valeri; Nihei, Kurt; Johnson, Lane; Jul. 2005; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435951; No Copyright; Avail: Defense Technical Information Center (DTIC)

Two- and three-dimensional numerical modeling was conducted to evaluate the performance of source-receiver arrays to 'detect' and 'locate' UXO in littoral environments. While the 2-D investigations were based on finite difference (FD) modeling, the 3-D study used an analytical solution for the scattering of elastic waves by spherical objects to model the interaction of waves with UXO. The forward modeling or 'detection' phase generated seismic data that reveal the presence of UXO in the subsurface.

DTIC

Contamination; Detection; Imaging Techniques; Mathematical Models; Ordnance

20050203788 Ohio Aerospace Inst., Cleveland, OH, USA

Photovoltaic Engineering Testbed on the International Space Station

Landis, Geoffrey A.; Scheiman, David; Sexton, Andrew; Abramczyk, Richard; Francz, Joseph; Johnson, D. B.; Yang, Liu; Minjares, Daniel; Myers, James; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 195-198; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Photovoltaic Engineering Testbed (PET) is a space-exposure test facility to fly on ISS to calibrate test, and qualify advanced solar cell types in space environment. The purpose is to reduce the cost of validating new technologies and bringing them to spaceflight readiness by measuring them in the in-space environment.

Author (revised)

Photovoltages; Performance Tests; Test Facilities; Cost Reduction

20050203935 Wayne State Univ., Detroit, MI, USA

Analysis of Social Science Theory through Computerization of Representations in Formal Logic

Levy, Sheldon G.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Natural science frequently has a great advantage in presenting statements with known logical consistency. This arises from the identification of a logical system, mathematics, with the elements under observation. Social science often does not have this advantage. Although there is no inherent reason why mathematics cannot be utilized in social science theory, the elements and relationships of interest are not readily perceived as corresponding to those of many popular mathematical systems. While exceptions exist, most social science theory is expressed in a series of verbal statements. However, it is not particularly difficult to convert these statements into formal logic. The problem is one of subsequently applying the methods of logic to the statements to arrive at important conclusions (theorems). Coupled with the nature of the elements and relationships in social science is the relative lack of formal training of many in the field. However, this may not be the key

issue. Even in physical science, fundamental questions arise from what appear to be inconsistencies expressed verbally. A case in point, which will not be argued further in this paper, is the big bang. Einstein's origin is a singularity from whose infinitesimally small corpus sprang the massive universe as now known. Logical questions have led to other mathematical approaches to solve the puzzles but this does not minimize the importance of the logical questions. (Veneziano, 2004 may illustrate this point. The particular computerized program for analyzing logical statements that will be employed in this paper was developed by Muncaster (2001) and is labeled propcalc (propositional calculus.). The theory to which the procedures will be applied is the Theory of reduced alternatives (Levy, 1970.). This theory attempts to explain a psychological consequence of systemic punishment that is counter to the frequently assumed effects. The core of the theory is that the deprivation of individuals in a society of adequate payoffs in institutional settings increases support for the government among those who are so deprived. This theory does not imply that the coerciveness of oppressive government is irrelevant in obtaining compliance. It proposes that there are psychological consequences, however, to certain conditions that actually lessen the need of the government to resort to coercion and which result in greater voluntary acceptance of the coercion. First the theory will be presented and then the formal symbolic logical analysis will be examined.

Derived from text

Computer Programs; Sociology; Mathematical Logic; Formalism

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

20050199663 Argonne National Lab., IL USA

Covariance Matrices for Nuclear Cross Sections Derived from Nuclear Model Calculations

Smith, D. L.; Nov. 2004; 30 pp.; In English

Report No.(s): DE2005-838257; ANL/NDM-159; No Copyright; Avail: Department of Energy Information Bridge

The growing need for covariance information to accompany the evaluated cross section data libraries utilized in contemporary nuclear applications is spurring the development of new methods to provide this information. Many of the current general purpose libraries of evaluated nuclear data used in applications are derived either almost entirely from nuclear model calculations or from nuclear model calculations benchmarked by available experimental data. Consequently, a consistent method for generating covariance information under these circumstances is required. This report discusses a new approach to producing covariance matrices for cross sections calculated using nuclear models. The present method involves establishing uncertainty information for the underlying parameters of nuclear models used in the calculations and then propagating these uncertainties through to the derived cross sections and related nuclear quantities by means of a Monte Carlo technique rather than the more conventional matrix error propagation approach used in some alternative methods. The formalism to be used in such analyses is discussed in this report along with various issues and caveats that need to be considered in order to proceed with a practical implementation of the methodology.

NTIS

Covariance; Matrices (Mathematics); Nuclear Models

20050199675 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

Nucleon Form Factors

De Jager, K.; January 2004; 14 pp.; In English

Report No.(s): DE2005-835635; No Copyright; Avail: Department of Energy Information Bridge

The experimental and theoretical status of elastic electron scattering from the nucleon is reviewed. As a consequence of new experimental facilities, data of unprecedented precision have recently become available for the electromagnetic and the strange form factors of the nucleon.

NTIS

Form Factors; Nucleons

20050199686 Eastern Research Group, Inc., Lexington, MA, USA

Report on the Homeland Security Workshop on Transport and Disposal of Wastes from Facilities Contaminated with Chemical or Biological Agents. Held in Cincinnati, Ohio on May 28-30, 2003

Wilhemi, J.; Nov. 2003; 52 pp.; In English; Report on the Homeland Security Workshop on Transport and Disposal of Wastes from Facilities Contaminated with Chemical or Biological Agents., May 28 - 30, 2003, Cincinnati, Ohio

Contract(s)/Grant(s): EPA-68-W-98-217

Report No.(s): PB2005-108396; No Copyright; Avail: CASI; A04, Hardcopy

This report summarizes discussions from the 'Homeland Security Workshop on Transport and Disposal of Wastes From Facilities Contaminated With Chemical or Biological Agents.' The workshop was held on May 28-30, 2003, in Cincinnati, Ohio, and its objectives were to: Document the current understanding of the challenges faced when handling, storing, transporting, and disposing of wastes from public and private facilities contaminated with chemical and biological agents. Identify research needs and opportunities for improving coordination between federal, state, and local government agencies and other stakeholders in order to fill gaps in the current understanding of these waste management challenges. This initial report summarizes discussions on the following seven topics: classes of chemical and biological agents; detection; effectiveness of decontamination; triaging of wastes; handling, storage, and transport of wastes; landfilling; and incineration. For each topic, this initial report outlines the current state of knowledge, identifies associated research needs, and lists action items identified during the discussions. The technical content of this report is based entirely on discussions at the workshop.

NTIS

Contamination; Environment Protection; Security

20050199699 Brookhaven National Lab., Upton, NY USA

Research Plan for Spin Physics at RHIC

Aidala, C.; Feb. 2005; 108 pp.; In English

Report No.(s): DE2005-15011678; BNL-73798; No Copyright; Avail: Department of Energy Information Bridge

In this report we present the research plan for the RHIC spin program. The report covers (1) the science of the RHIC spin program in a world-wide context; (2) the collider performance requirements for the RHIC spin program; (3) the detector upgrades required, including timelines; (4) time evolution of the spin program.

NTIS

Research Projects; Particle Spin; Field Theory (Physics)

20050199712 Lawrence Livermore National Lab., Livermore, CA USA

Incipient Spallation Fracture in Light Metals from 3D X-Ray Tomography, 2D Microscopy, and Molecular Dynamics Simulations

Belak, J.; Cazamias, J. U.; Chau, R.; Haupt, D.; Kinney, J. H.; Jun. 28, 2004; 12 pp.; In English

Report No.(s): DE2005-15011629; UCRL-CONF-204946; No Copyright; Avail: Department of Energy Information Bridge

The dynamic fracture of ductile metals is known to occur through the nucleation and growth of microscopic voids. As the voids grow, the surrounding metal is plastically deformed to accommodate the change in void volume. In order to gain better insight into void growth, gas gun recovery experiments were used to study incipient spallation fracture in light metals (Al, Cu, V). In addition to in-situ free surface velocity wave-profiles, the recovered samples were first analyzed using 3D X-ray tomography and then sectioned for 2D microscopy. The void size and spatial distribution were determined directly from the X-ray tomography. The single crystal samples show a bimodal distribution of small voids with large (50 -100 micron) well separated voids. The plastically damaged region surrounding the large voids is quantified using optical and electron backscattering microscopy. Microhardness measurements indicate this region to be harder than the surrounding metal. Concurrently, a molecular dynamics model of void nucleation and growth at high strain-rate was developed. The model is consistent with experimental observations, e.g. voids nucleate at the weakest points in the metal such as inclusions and grain boundary junctions.

NTIS

Fracturing; Metals; Microscopy; Molecular Dynamics; Molecular Structure; Simulation; Spallation; Tomography; X Rays

20050199714 California Univ., Berkeley, CA USA

Efficiency Improvement of Crystalline Solar Cells. Final Subcontract Report

Weber, E. R.; Feb. 2005; 36 pp.; In English

Report No.(s): DE2005-15011471; No Copyright; Avail: Department of Energy Information Bridge

The approach in this subcontract was to use unique analytical tools available at Berkeley to perform systematic fundamental physical studies of the distribution and chemical state of metal clusters in a variety of multicrystalline silicon materials. Two analytical techniques were essential for the success of this project. The total metal concentration in the areas of multicrystalline silicon with high and low lifetime was determined by neutron activation analysis, a technique that involves irradiation of a sample with neutrons in a nuclear reactor and analysis of its residual radioactivity. The distribution and chemical state of metal clusters was characterized by synchrotron radiation-based X-ray microscopes available at the Advanced Light Source (Beamlines 10.3.1 and 10.3.2) at Lawrence Berkeley National Laboratory and Advanced Photon Source (Beamlines 2-ID-D and 20-ID-B) at Argonne National Laboratory.

NTIS

Crystallinity; Neutron Activation Analysis; Photons; Silicon; Solar Cells

20050199724 Brown Univ., Providence, RI, USA

Theory of the Knight Shift and Flux Quantization in Superconductors

Cooper, L. N.; Lee, H. J.; Schwartz, B. B.; Silvert, W.; May 1963; 18 pp.; In English

Report No.(s): DE2005-4720526; No Copyright; Avail: Department of Energy Information Bridge

Consequences of a generalization of the theory of superconductivity that yields a finite Knight shift are presented. In this theory, by introducing an electron-electron interaction that is not spatially invariant, the pairing of electrons with varying total momentum is made possible. An expression for X_s (the spin susceptibility in the superconducting state) is derived. In general X_s is smaller than X_n , but is not necessarily zero. The precise magnitude of X_s will vary from sample to sample and will depend on the nonuniformity of the samples. There should be no marked size dependence and no marked dependence on the strength of the magnetic field; this is in accord with observation. The basic superconducting properties are retained, but there are modifications in the various electromagnetic and thermal properties since the electrons paired are not time sequences of this generalized theory on flux quantization arguments are presented.

NTIS

Flux Quantization; Nuclear Magnetic Resonance; Superconductivity; Superconductors (Materials)

20050199725 Minnesota Univ., Minneapolis, MN, USA

Nuclear Physics of Core-Collapse Supernovae. (Report for August 15, 2000-August 14, 2004)

Oct. 26, 2004; 18 pp.; In English

Report No.(s): DE2005-834073; No Copyright; Avail: Department of Energy Information Bridge

During the funding period from August 15, 2000 to August 14, 2004, the main foci of my research have been implications of abundances in metal-poor stars for nucleosynthetic yields of supernovae and chemical evolution of the universe, effects of neutrino oscillations and neutrino-nucleus interactions on r-process nucleosynthesis, physical conditions in neutrino-driven winds from proto-neutron stars, neutrino driven mechanism of supernova explosion, supernova neutrino signals in terrestrial detectors, and constraints on variations of fundamental couplings and astrophysical conditions from properties of nuclear reactions. Personnel (three graduate students and a postdoctoral research associate) involved in my research are listed in section 2. Completed research projects are discussed in section 3. Publications during the funding period are listed in section 4 and oral presentations in section 5. Remarks about the budget are given in section 6.

NTIS

Collapse; Nuclear Physics; Supernovae

20050199729 Fermi National Accelerator Lab., Batavia, IL, USA

Accelerator Scenario and Parameters for the First Muon Collider and Front-End of a Muon Collider

Ankenbrandt, C.; Geer, S.; Mar. 1998; 12 pp.; In English

Report No.(s): DE2005-16568; No Copyright; Avail: Department of Energy Information Bridge

In November 1997 a workshop was held at Fermilab to explore the physics potential of the first muon collider, and the physics potential of the accelerator complex at the 'front-end' of the collider. This paper describes the configuration of the muon collider accelerator complex, including the major accelerator parameters, and the particle fluxes and luminosities that would result from such a facility.

NTIS

Muons; Luminosity; Particle Accelerators

20050199731 Lawrence Livermore National Lab., Livermore, CA USA

Obtaining Identical Results on Varying Numbers of Processors in Domain Decomposed Particle Monte Carlo Simulations

Gentile, N. A.; Kalos, M. H.; Brunner, T. A.; Mar. 24, 2005; 16 pp.; In English

Report No.(s): DE2005-15015123; UCRL-PROC-210823; No Copyright; Avail: Department of Energy Information Bridge

Domain decomposed Monte Carlo codes, like other domain-decomposed codes, are difficult to debug. Domain decomposition is prone to error, and interactions between the domain decomposition code and the rest of the algorithm often produces subtle bugs. These bugs are particularly difficult to find in a Monte Carlo algorithm, in which the results have statistical noise. Variations in the results due to statistical noise can mask errors when comparing the results to other simulations or analytic results. If a code can get the same result on one domain as on many, debugging the whole code is easier. This reproducibility property is also desirable when comparing results done on different numbers of processors and domains. We describe how reproducibility, to machine precision, is obtained on different numbers of domains in an Implicit Monte Carlo photonics code.

NTIS

Monte Carlo Method; Quantum Mechanics; Domains

20050200800 University of Southern California, Los Angeles, CA USA

Pulsed Electric Fields for Biological Weapons Defense

Gundersen, Martin A.; Jan. 2002; 12 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0073

Report No.(s): AD-A435273; AFRL-SR-AR-TR-05-0146; No Copyright; Avail: CASI; [A03](#), Hardcopy

The project has demonstrated that ultra-short, high-field pulses are a useful tool for study of cellular responses. The research has established that intracellular effects including apoptosis can be induced by the application of short, intense (but low total energy) electric pulses, and has seen variability in cell response. Experiments on human cells have produced convincing evidence that these applied fields nondestructively alter subcellular processes and can be investigated using biophotonic studies for imaging of morphological and functional changes at subcellular levels. In particular, it is clear that there are a range of responses to intense, ultra-short pulses, and that many lines of spores and cells require study. Technology for the application of pulses has been developed, and results of studies of toxicity have been undertaken, including detailed studies of *Bacillus atrophaeus* (formerly *Bacillus subtilis* var. *niger*).

DTIC

Biological Weapons; Electric Fields; Warfare

20050200845 HY-Tech Research Corp., Radford, VA USA

Heterodyne Interferometer for Triggering Gas-Puff PRSs

Hazelton, Robert C.; May 2004; 33 pp.; In English

Contract(s)/Grant(s): DTRA01-03-P-0241

Report No.(s): AD-A435380; No Copyright; Avail: CASI; [A03](#), Hardcopy

Consistent timing between the injection of gas in plasma radiation sources (PRSs) and the generator current pulse is crucial to producing high-yield x-ray pulses. This Phase 1 SBIR effort has shown that triggering modes currently used in DTRA's x-ray simulator program (high voltage trigger pin; command fire mode) introduce an effective variation in initial load mass of +/-11%, and this may be as high as +/-20%. This variation is so large that it can completely mask any PRS improvement attempted in the x-ray simulator R&D program, and result in approx. 20% variation in x-ray yield. This effort demonstrated the utility of a compact, heterodyne interferometer trigger system to reduce effective variation in load mass, where variations as low as +/-1.5% may be possible. The interferometer system can monitor the gas puff time history, with resulting data used to improve the density profile of each simulator shot. It will also help to quantify the amount of pre-ionization and early electron density buildup for the plasma radiation sources.

DTIC

Heterodyning; Interferometers

20050200861 Naval Postgraduate School, Monterey, CA USA

The Extent of DoD Influence on the Development and Application of Radio Frequency (RFID) Technology in the Civilian Sector

Acevedo, Rafael A.; Cooper, Robert W.; Jun. 2005; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435437; No Copyright; Avail: Defense Technical Information Center (DTIC)

It would be a fair argument to say that there is perhaps no invention that has had as much impact on the world as that of the Internet. The internet, however, was conceived in the minds of government employees. Just as Government influenced the development of the internet, the same can be said of Radio Frequency Identification (RFID) Technology. The DoD had a very large impact on the development of RFID. Many DoD funded projects and experiments helped pave the way for and significantly influenced the development of RFID technology. This project examines the extent of that DoD influence and shows the correlation between DoD and RFID developments in the civilian sector. From Defense projects in minefields location to tracking containers in ships on the high seas in support of the war on terror, this project explains how specific Government sponsored projects had a direct influence on the current state of RFID technology.

DTIC

Detection; Radio Frequencies; Radio Waves

20050200931 Naval Postgraduate School, Monterey, CA USA

Detection of Frequency-Hopped Signals Embedded in Interference Waveforms

Brown, Christopher; Jun. 2005; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435584; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many military communications systems utilize frequency-hopped spread spectrum waveforms to protect against jamming and enemy detection. These waveforms may be subjected not only to intentional jamming but may also be unintentionally jammed by other communications signals. While some systems can overcome inband interference with more signal power, covert systems may be limited to small amounts of transmitted power. The objective of this thesis was to investigate a method for resolving a frequency-hopped signal embedded in interference waveforms. With exponential averaging in the frequency domain, the spectra of the interfering signals can be estimated as long as they are present over a period longer than that of the frequency-hopped signal. Certain FFT sizes and weights are more beneficial to achieving this estimate than others. The interference estimate can be used to extract the desired frequency-hopped signal through spectral division of the received signal with the estimate. This technique is designated as noise-normalization. Simulations in MATLAB demonstrate the use of the technique and show how the desired signal can be resolved.

DTIC

Embedding; Frequencies; Frequency Hopping; Waveforms

20050200983 Naval Postgraduate School, Monterey, CA USA

A Counterpulsed, Solid-State Opening Switch

Graham, Michael; Jun. 2005; 48 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435683; No Copyright; Avail: Defense Technical Information Center (DTIC)

Railguns have great potential in military roles; however, they currently lack a fieldable power supply. Recent advances in the state of low voltage power storage devices may enable practical Pulse Forming Inductive Network power supplies to be developed if a suitable current interruption device is developed. A solid-state device in a counterpulsed opening switch configuration is a possible solution. A demonstration counterpulsed solid-state opening switch was constructed and successfully tested. This circuit consisted of Silicon Controlled Rectifier components, which can nominally only turn on current. The counterpulsed configuration allowed them to function as opening switches and to do so at much higher current relative to their specifications. We demonstrated current interruption at up to 1 kA of peak current. This demonstration system validates the counterpulsing concept and prepares for the construction of a modular, 250 kJ system.

DTIC

Railgun Accelerators; Solid State; Switches

20050200995 Air Force Research Lab., Edwards AFB, CA USA

Overview of Proposed Joint Air Force and Navy Subscale Fast Cook-off Program

Schwartz, Daniel F.; Atwood, Alice I.; Bui, D. T.; Rattanapote, Melody; Butcher, A. G.; May 2005; 39 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A435713; No Copyright; Avail: Defense Technical Information Center (DTIC)

Department of Defense (DoD) and Department of Transportation (DOT) hazards classifiers as well as propulsion hazards personnel from the military and industry have long recognized the potential hazards of storage and transportation of solid rocket motors. DoD hazard classification guidelines in Technical Bulletin (TB) 700-2, NAVSEAINST 8020.8B, TO 11A-1-47, and DLAR 8220.1 (hereafter referred to as TB 700-2), and 49 CFR 100-180, UN Test Manual, and other related documents address the specifics of testing and classifying materials and articles containing explosives. At the present time, the Department

of Defense Explosive Safety Board (DDESB) and Joint Hazard Classifiers (JHC) require compliance with the United Nations (UN) Test Series 6 (c) external fire fast cook-off (FCO) test protocol (or pre-approved test plan) for any solid propellant system that is to be classified into Hazard Divisions 1.1, 1.2, 1.3 and 1.4. The protocol requires that full-scale articles in their shipping containers be subjected to a series of external fire FCO tests and meet the specific requirements as listed in TB700-2 to qualify for a Hazard Division (HD) 1.3 classification. A project is described to identify the critical features needed for a subscale analytical and experimental alternative to the UN Test Series 6 (c) external fire FCO test protocol. The work would include a definition of fire scenarios and characteristics of the fire hazards associated with transportation and storage of large rocket motors. The response of an item to thermal threat would be obtained through the compilation of existing data, in combination with a synergistic analytical and experimental program. A hazards response protocol, which identifies the controlling parameters of fast cook-off, would be generated. Analytical tools would be used to perform a sensitivity analysis on the control to identify their importance.

DTIC

Fires; Firing (Igniting); Hazards; Solid Propellant Rocket Engines

20050201094 Naval Postgraduate School, Monterey, CA USA

Modeling and Simulation of the Physical Layer of the Single Channel Ground and Airborne Radio System (SINCGARS)

Paradise, Richard A.; Jun. 2005; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435904; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this thesis, the physical layer of the Single Channel Ground and Airborne Radio System (SINCGARS) was analyzed to gain insight into the bit-error-rate (BER) performance in various channel conditions. The BER performance of the radio was examined using theoretical, simulation, and experimental techniques. These results are presented in graphical form as the probability of bit error as a function of the energy-per-bit to noise-power-spectral-density ratio. The results of the simulation show excellent agreement with the theory, while the experimental results deviate from theory at higher signal-to-noise levels. This suggests sub-optimal SINCGARS performance, most notably in the signal-power to noise-power range where reliable data transmission should take place.

DTIC

Airborne Equipment; Data Transmission; Radio Equipment; Random Noise; Signal to Noise Ratios; Simulation

20050201590 Naval Undersea Warfare Center, Newport, RI USA

Electromagnetic Wave Propagation Scheme

Bruno, Anthony B., Inventor; Apr. 2005; 16 pp.; In English

Report No.(s): AD-D020205; No Copyright; Avail: CASI; [A03](#), Hardcopy

An apparatus for effecting propagation of electromagnetic waves, comprising a hull outer surface, a dielectric material disposed over the hull outer surface, and an electrically conductive member embedded within the dielectric material. When a liquid medium contacts the dielectric material, the liquid medium, the hull outer surface, the dielectric material and the electrically conductive member cooperate to provide a waveguide through which electromagnetic waves can propagate wherein the boundaries of the waveguide are defined by the liquid medium and the hull outer surface. A sensor network can be provided within the dielectric material for receiving power and transmitting information.

DTIC

Dielectrics; Electromagnetic Wave Transmission

20050201595 Naval Undersea Warfare Center, Newport, RI USA

Acquisition System Particularly Suited for Tracking Targets Having High Bearing Rates

Kneipfer, Ronald R., Inventor; Mar. 2005; 32 pp.; In English

Report No.(s): AD-D020210; No Copyright; Avail: CASI; [A03](#), Hardcopy

An apparatus for a bearing tracker is disclosed that provides improved estimates of target's bearing, bearing rate and signal-to-noise (SNR). The estimates are computed using normalized beam spectral data from short time interval preceding the initialization process.

DTIC

Signal to Noise Ratios; Target Acquisition; Targets

20050201600 Lawrence Livermore National Lab., Livermore, CA USA

Ab Initio Large-Basis No-Core Shell Model

Barrett, B. R.; Navratil, P.; Nogga, A.; Ormand, W. E.; Stetcu, I.; Mar. 08, 2005; 12 pp.; In English

Report No.(s): DE2005-15011511; UCRL-PROC-210305; No Copyright; Avail: Department of Energy Information Bridge

We discuss the motivation, theory, and formulation of the ab initio No-Core Shell Model (NCSM). In this method the effective Hamiltonians are derived microscopically from realistic nucleon-nucleon (NN) and theoretical three-nucleon (NNN) potentials, as a function of the finite harmonic-oscillator (HO) basis space. We present converged results for the $A = 3$ and 4 nucleon systems, which are in agreement with results obtained by other exact methods, followed by results for p-shell nuclei. Binding energies, rms radii, excitation spectra, and electromagnetic properties are discussed. The favorable comparison with available data is a consequence of the underlying NN and NNN interactions rather than a phenomenological fit.

NTIS

Phenomenology; Harmonic Oscillators; Nuclear Binding Energy

20050201620 Naval Postgraduate School, Monterey, CA USA

Tracking Human Walking Using MARG Sensors

Pantazis, Ioannis; Jun. 2005; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435450; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis addresses modeling and simulation of the human lower extremities in order to track walking motion and estimate walking distance. The lower extremities are modeled as an articulated object, which consists of rigid bars connected to each other by joints. This model is tested by using both synthetic and real data. The synthetic data is created based on the main principles of biomechanics. The real data is obtained from MARG sensors and is processed by the Factored Quaternion algorithm. Next, it is implemented in a simulation program written in Matlab. The program utilizes a mathematical model that represents the human gait-cycle and is based on the theory of forward kinematics as well as on the theory of manipulator kinematics. The simulation program is able to track the motion of the limbs that presents the lower extremities and estimate the traveled distance. Extensive laboratory tests verified the validity of the configuration.

DTIC

Biodynamics; Kinematics; Manipulators; Simulation; Walking

20050201914 Geophysical Observatory, Sodankyla, Finland

Magnetic Results: Sodankyla 2004

Kultima, Johannes, Editor; 2005; ISSN 1456-3673; 41 pp.; In English

Report No.(s): Rept-97; Copyright; Avail: Other Sources

The Sodankyla Geophysical Observatory was established in 1913; 1914 was the first year of magnetic recordings. The observatory is situated on the east bank of the river Kitinen, ca. 5 k m south of Sodankyla village. Until 31.07.1997 it belonged to the Finnish Academy of Science and Letters. Since 01.08.1997 it has been the independent observatory of the University of Oulu.

Derived from text

Geophysical Observatories; Magnetic Effects; Magnetic Flux

20050201930 Princeton Univ., NJ, USA, Syracuse Univ., NY, USA

Happex Experiment at Jefferson Laboratory

Kumar, K. S.; Souder, P. A.; January 2005; 14 pp.; In English

Report No.(s): DE2005-833154; No Copyright; Avail: Department of Energy Information Bridge

A new experimental program is under way at Jefferson Laboratory to probe the strange structure of the nucleon via parity violating electron scattering, HAPPEX is the first experiment from this program to run Jefferson Laboratory. We describe the physics motivation, provide an experimental overview and report on the results from the first data run. The asymmetry for the elastic scattering of 3.3 GeV electrons off target protons at a scattering angle of 12.5 degrees was measured to a precision of 15% of itself. The contribution from strange quark form factors was found to be zero within the experimental and theoretical uncertainties.

NTIS

Asymmetry; Elastic Scattering; Linear Accelerators

20050201936 Lawrence Livermore National Lab., Livermore, CA USA

Dielectrophoretic Forces on the Nanoscale

Schaldach, C. M.; Bourcier, W. L.; Paul, P. H.; Wilson, W. D.; Apr. 20, 2004; 38 pp.; In English

Report No.(s): DE2005-15013927; UCRL-TR-203675; No Copyright; Avail: Department of Energy Information Bridge

We have developed a method of calculation of the dielectrophoretic force on a nanoparticle in a fluid environment where variations in the electric field and electric field gradients are on the same nanoscale as the particle. The Boundary Element Dielectrophoretic Force (BEDF) method involves constructing a solvent-accessible or molecular surface surrounding the particle, calculating the normal component of the electric field at the surface boundary elements and then solving a system of linear equations for the induced surface polarization charge on each element. Different surface elements of the molecule may experience quite different polarizing electric fields, unlike the situation in the point dipole approximation. A single 100 angstrom radius ring test configuration is employed to facilitate comparison with the well-known point dipole approximation (PDA). We find remarkable agreement between the forces calculated by the BEDF and PDA methods for a 1 angstrom polarizable sphere. However, for larger particles, the differences between the methods become qualitative as well as quantitative; the character of the force changes from attractive at the origin of the ring for a 50 angstrom sphere, to repulsive for a 75 angstrom sphere. Equally dramatic differences are found in a more complex electrical environment involving two sets of 10 rings.

NTIS

Nanostructures (Devices); Nanoparticles; Solvents

20050201941 Lawrence Livermore National Lab., Livermore, CA USA

Development and Testing of the Improved Focusing Quadrupole for Heavy Ion Fusion Accelerators

Martovetsky, N. N.; Manahan, R. R.; Meinke, R. B.; Chiesa, L.; Lietzke, A. F.; Oct. 23, 2003; 22 pp.; In English

Report No.(s): DE2005-15013675; UCRL-CONF-200512; No Copyright; Avail: Department of Energy Information Bridge

An improved version of the focusing magnet for a Heavy Ion Fusion (HIF) accelerator was designed, built and tested in 2002-2003. This quadrupole has higher focusing power and lower error field than the previous version of the focusing quadrupoles successfully built and tested in 2001. We discuss the features of the new design, selected fabrication issues and test results.

NTIS

Inertial Confinement Fusion; Ion Accelerators; Quadrupoles

20050201970 Lawrence Livermore National Lab., Livermore, CA USA

Development of Lower Energy Neutron Spectroscopy for Area Density Measurement in Implosion Experiment at NIF and OMEGA

Izumi, N.; Lerche, R. A.; Phillips, T. W.; Schmid, G. J.; Moran, M. J.; January 2005; 14 pp.; In English

Report No.(s): DE2005-15013227; UCRL-JC-142032; No Copyright; Avail: Department of Energy Information Bridge

Areal density (pR) is a fundamental parameter that characterizes the performance of an ICF implosion. For high areal densities (pR/g 0.1 g/cm (sup 2)), which will be realized in implosion experiments at NIF and LMJ, the target areal density exceeds the stopping range of charged particles and measurements with charged particle spectroscopy will be difficult. In this region, an areal density measurement method using down shifted neutron counting is a promising alternative. The probability of neutron scattering in the imploded plasma is proportional to the areal density of the plasma. The spectrum of neutrons scattered by the specific target nucleus has a characteristic low energy cut off. This enables separate, simultaneous measurements of fuel and pusher pRs. To apply this concept in implosion experiments, the detector should have extremely large dynamic range. Sufficient signal output for low energy neutrons is also required. A lithium-glass scintillation-fiber plate (LG-SCIFI) is a promising candidate for this application. In this paper we propose a novel technique based on downshifted neutron measurements with a lithium-glass scintillation-fiber plate. The details of instrumentation and background estimation with Monte Carlo calculation are reported.

NTIS

Density Measurement; Ignition; Implosions; Neutron Flux Density; Neutrons; Spectroscopy

20050201971 Lawrence Livermore National Lab., Livermore, CA USA

DARHT-II Downstream Beam Transport Beamline

Westenskow, G. A.; Bertolini, L. R.; Duffy, P. T.; Paul, A. C.; Aug. 2000; 10 pp.; In English

Report No.(s): DE2005-15013242; UCRL-JC-138265; No Copyright; Avail: Department of Energy Information Bridge

This paper describes the mechanical design of the downstream beam transport line for the second axis of the Dual Axis Radiographic Hydrodynamic Test (DARHT II) Facility. The DARHT-II project is a collaboration between LANL, LBNL and LLNL. DARHT II is a 20-MeV, 2000-Amperes, 2-micro sec linear induction accelerator designed to generate short bursts of x-rays for the purpose of radiographing dense objects. The downstream beam transport line is approximately 20-meter long region extending from the end of the accelerator to the bremsstrahlung target. Within this proposed transport line there are 15 conventional solenoid, quadrupole and dipole magnets; as well as several speciality magnets, which transport and focus the beam to the target and to the beam dumps. There are two high power beam dumps, which are designed to absorb 80-kJ per pulse during accelerator start-up and operation. Aspects of the mechanical design of these elements are presented.

NTIS

Mechanical Engineering; Linear Accelerators; Radiography

20050201973 Lawrence Livermore National Lab., Livermore, CA USA

Effect of Thermal Annealing and Second Harmonic Generation on Bulk Damage Performance of Rapid-Growth KDP Type I Doublers at 1064 nm

Runkel, M.; Maricle, S.; Torres, R.; Auerbach, J.; Floyd, R.; Dec. 11, 2000; 18 pp.; In English

Report No.(s): DE2005-15013174; UCRL-JC-139619; No Copyright; Avail: Department of Energy Information Bridge

This paper discusses the results of thermal annealing and in-situ second harmonic generation (SHG) damage tests performed on six rapid growth KDP type 1 doubler crystals at 1064 nm on the Zeus automated damage test facility. Unconditioned (S/I) and conditioned (R/I) damage probability tests were performed before and after thermal annealing, then with and without SHG on six doubler crystals from the NIF-size, rapid growth KDP boule F6.

NTIS

Annealing; Crystals; Damage; Evaluation; Harmonic Generations; Performance Tests; Temperature Effects; Thermal Energy

20050201974 Lawrence Livermore National Lab., Livermore, CA, USA

NIF Inert Gas/Vacuum Management Prestart Review Phase 3 - Permit Spatial Filter Vacuum

Mar. 2001; 86 pp.; In English

Report No.(s): DE2005-15013286; UCRL-ID-143148; No Copyright; Avail: Department of Energy Information Bridge

A Management Prestart Review (MPR) for the National Ignition Facility (NIF) vacuum testing of spatial filters, the Cavity Spatial Filter (CSF) and the Transport Spatial Filter (TSF), was conducted during March 2001. The review was performed to determine the readiness of the Beamline Infrastructure System (BIS) team and the Integration Management and Installation (IMI) contractor to start the vacuum testing of the components and assemblies that constitute the four CSF clusters and four TSF clusters in the NIF laser. This review assures that appropriate engineering, planning and management is in place to start this testing. Completion and acceptance of this report satisfies the LLNL requirement for MPRs to be conducted whenever a significant new risk is introduced into a project and is an essential part of the ISM work authorization process. This MPR provides to the NIF Project Manager an independent, systematic assessment of readiness of line management to start vacuum testing; completeness of planning for this testing; readiness of personnel to conduct this testing; and hazards inherent in this testing and implementation of prevention and mitigation activities to minimize the chance of injuries and damage to equipment and facilities during this testing.

NTIS

Cavities; Ignition; Rare Gases; Spatial Filtering; Vacuum

20050201984 Lawrence Livermore National Lab., Livermore, CA USA

High pT Hadron Spectra at RHIC: an Overview

Klay, J. L.; Oct. 21, 2004; 18 pp.; In English

Report No.(s): DE2005-15011585; UCRL-PROC-207407; No Copyright; Avail: Department of Energy Information Bridge

Recent results on high transverse momentum (pT) hadron production in p+p, d+Au and Au+Au collisions at the Relativistic Heavy Ion Collider (RHIC) are reviewed. Comparison of the nuclear modification factors, $R_{\text{sub dAu}}(pT)$ and $R_{\text{sub AA}}(pT)$, demonstrates that the large suppression in central Au+Au collisions is due to strong final-state effects. Theoretical models which incorporate jet quenching via gluon Bremsstrahlung in the dense partonic medium that is expected in central Au+Au collisions at ultra-relativistic energies are shown to reproduce the shape and magnitude of the observed suppression over the range of collision energies so far studied at RHIC.

NTIS

Hadrons; Spectra; Mathematical Models

20050201985 Lawrence Livermore National Lab., Livermore, CA USA

Studies of the Pulse-Line Accelerator Using a Circuit Model

Friedman, A.; Mar. 14, 2005; 16 pp.; In English

Report No.(s): DE2005-15011518; UCRL-TR-210492; No Copyright; Avail: Department of Energy Information Bridge

This note describes a simple model developed to explore some of the properties of the pulse-line ion accelerator, here represented as a series of lumped elements, in the general parameter regime for the 'NDCX-1d' experiments. The goals of this modeling are: to understand the evolution of various possible input pulses in the presence of dispersive effects and imperfect termination of the line; to examine scenarios for beam acceleration; and to explore the effects of 'beam loading', that is, changes to the voltages along the helical line that result from the interaction of the beam's return current with the 'circuitry' of that line. In Section 1 below, the model is described and the method of solution outlined; in Section 2, a low-current example of beam acceleration is presented; in Section 3, runs are presented showing the development of beam loading-induced voltages as model pulses are followed; in section 4, the modeling of a higher-current beam under acceleration is presented, and the effects of beam loading quantified; and in section 5, a brief summary of complementary efforts and of plans to extend the modeling is presented.

NTIS

Circuits; Low Currents; Electric Potential

20050201990 Lawrence Livermore National Lab., Livermore, CA USA

Symmetry Experiments on Omega with LMJ like Multiple Beam Cones Irradiation

Richard, A. L.; Jadaud, J. P.; Dague, N.; Monteil, M. C.; Turner, R. E.; Jul. 17, 2000; 10 pp.; In English

Report No.(s): DE2005-15013167; UCRL-JC-137873; No Copyright; Avail: Department of Energy Information Bridge

We carried out a set of experiments on the Omega laser facility at Rochester with Laser MCgaJoule (LMJ) like indirect drive irradiation. We studied the irradiation non-uniformity with the foam ball radiography technique and the implosion symmetry with (D(sub 2) + Argon) filled capsules core emission. Cylindrical 'Nova scale 1' thin wall hohlraums were used. Forty of the Omega beams, arranged in three cones on each side of the hohlraum (5, 5, and 10), were used to create the X-ray drive. Eight additional beams were used on a Ti source to radiograph the foam balls. The shaped laser pulse was about 3 ns duration. The radiation drive was measured on each shot. The images were recorded with a 5 micron m resolution Gated X-ray Imager coupled to a CCD camera.

NTIS

Irradiation; Symmetry

20050201991 Lawrence Livermore National Lab., Livermore, CA USA

Wall Conditioning and Power Balance for Spheromak Plasmas in SSPX

Hill, D. N.; Wood, R. D.; Bulmer, R.; McLean, H. S.; Ryutov, D. D.; Aug. 07, 2002; 22 pp.; In English

Report No.(s): DE2005-15013317; UCRL-JC-149573; No Copyright; Avail: Department of Energy Information Bridge

We report here results from power balance measurements for ohmically-heated plasmas in the Sustained Spheromak Physics Experiment (SSPX). The plasma is formed inside a close-fitting tungsten-coated copper shell; wall conditioning by baking, glow discharge cleaning (GDC), Ti gettering, and helium shot conditioning produces clean plasmas (Z_{eff} less than 2.5) and reduces impurity radiation to a small fraction of the input energy, except when the molybdenum divertor plate has been overheated. We find that most of the input energy is lost by conduction to the walls (the divertor plate and the inner electrode in the coaxial source region). Recently, carborane was added during GDC to boronize the plasma-facing surfaces, but little benefit was obtained.

NTIS

Plasmas (Physics); Spheromaks; Walls

20050201992 Brookhaven National Lab., Upton, NY USA

Search for New Physics at a Super-B Factory

Browder, T. E.; Soni, A.; Jan. 2005; 34 pp.; In English

Report No.(s): DE2005-15011305; BNL-73702; No Copyright; Avail: Department of Energy Information Bridge

The importance of a Super-B Factory in the search for New Physics, in particular, due to CP-od phase(s) from physics beyond the Standard Model is surveyed. The first point to emphasize is that we know now how to directly measure all three angles of the unitarity triangle very cleanly, i. e. without theoretical assumptions with irreducible theory error (1 σ) 1%; however this requires much more luminosity than is currently available at B-factories. Direct searches via penguin-dominated hadronic

modes as well as radiative, pair-leptonic and semi-leptonic decays are also discussed. Null tests of the SM are stressed as these will play a crucial role especially if the effects of BSM phase(s) on B-physics are small.

NTIS

Heat Measurement; Industrial Plants

20050201994 Lawrence Livermore National Lab., Livermore, CA USA

Polarization Studies in Fast-Ion Beam Spectroscopy

Trabert, E.; Jun. 18, 2002; 16 pp.; In English

Report No.(s): DE2005-15013559; UCRL-JC-145267; No Copyright; Avail: Department of Energy Information Bridge

In a historical review, the observations and the insight gained from polarization studies of fast ions interacting with solid targets are presented. These began with J. Macek's recognition of zero-field quantum beats in beam-foil spectroscopy as indicating alignment, and D.G. Ellis' density operator analysis that suggested the observability of orientation when using tilted foils. Lastly H. Winter's studies of the ion-beam surface interactions at grazing incidence yielded the means to produce a high degree of nuclear orientation in ion beams.

NTIS

Ion Beams; Spectroscopy

20050202005 Lawrence Livermore National Lab., Livermore, CA USA

Optical Parametric Amplification for High Peak and Average Power

Jovanovic, I.; Nov. 26, 2001; 184 pp.; In English

Report No.(s): DE2005-15013363; UCRL-LR-146433; No Copyright; Avail: Department of Energy Information Bridge

Optical parametric amplification is an established broadband amplification technology based on a second-order nonlinear process of difference-frequency generation (DFG). When used in chirped pulse amplification (CPA), the technology has been termed optical parametric chirped pulse amplification (OPCPA). OPCPA holds a potential for producing unprecedented levels of peak and average power in optical pulses through its scalable ultrashort pulse amplification capability and the absence of quantum defect, respectively.

NTIS

Amplification; Optical Properties

20050202007 Lawrence Livermore National Lab., Livermore, CA USA

ENDL Type Formats for the LLNL Evaluated Atomic Data Library (EADL), Evaluated Electron Data Library (EEDL), and Evaluated Photon Data Library (EPDL)

Perkins, S. T.; Cullen, D. E.; May 17, 2002; 38 pp.; In English

Report No.(s): DE2005-15013373; UCRL-ID-117796-REV-1; No Copyright; Avail: Department of Energy Information Bridge

The character file formats for the Lawrence Livermore National Laboratory evaluated atomic relaxation library (EADL), the electron library (EEDL), and the photon library (EPDL) are given in this report.

NTIS

Atoms; Format; Libraries; Photons

20050203908 Chicago Univ., Chicago, IL, USA

Space, Time, Matter and Force

Freund, Peter G. O.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 13 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Our understanding of the four basic concepts of physics: space, time, matter and force, has undergone radical change in the course of work on unification, beginning with Maxwell's unification of electricity with magnetism in the nineteenth century, all the way to present day string theory. What started out as four independent concepts, with space and time postulated and the forms of matter and force arbitrarily chosen, now appear as different aspects of a rich and novel dynamically determined geometric structure. In this paper I present these new developments.

Author

Time; Space; Physics; Force

20050203983 NASA Glenn Research Center, Cleveland, OH, USA

Experimental Study of Large-Amplitude Faraday Waves in Rectangular Cylinders

Iek, Chanthy; Alexander, Iwan J.; Tin, Padetha; Adamovsky, Gregory; [2005]; 1 pp.; In English; AIAA 63rd Aerospace Science Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): 22-101-53-01; No Copyright; Avail: Other Sources; Abstract Only

Experiment on single-mode Faraday waves having two, three, and four wavelengths across a rectangular cylinder of high aspect ratio is the subject of discussion. Previous experiments recently done by Henderson & Miles (1989) and by Lei Jiang et. al (1996) focused on Faraday waves with one and two wavelengths across rectangular cylinders. In this experimental study the waves steepness ranges from small at threshold levels to a large amplitude which according to Penny & Price theory (1952) approaches the maximum sustainable amplitude for a standing wave. The waves characteristics for small amplitudes are evaluated against an existing well known linear theory by Benjamin & Ursell (1954) and against a weakly nonlinear theory by J. Miles (1984) which includes the effect of viscous damping. The evaluation includes the wave neutral stability and damping rate. In addition, a wave amplitude differential equation of a linear theory including viscous effect by Cerda & Tirapegui (1998) is solved numerically to yield prediction of temporal profiles of both wave damping and wave formation at the threshold. An interesting finding from this exercise is that the fluid kinematic viscosity needs to increase ten times in order to obtain good agreement between the theoretical prediction and the experimental data for both wave damping and wave starting. For large amplitude waves, the experimental data are evaluated against the theory of Penny & Price which predicts wave characteristics of any amplitude up to the point at which the wave reaches its maximum amplitude attainable for a standing wave. The theory yields two criteria to show the maximum wave steepness, the vertical acceleration at the wave crest of half the earth gravity field acceleration and the including angle at the crest of 90 degrees. Comparison with experimental data shows close agreement for the wave crest acceleration but a large discrepancy for the including angle. Additional information is included in the original extended abstract.

Author (revised)

Standing Waves; Rectangles; Cylindrical Chambers; High Aspect Ratio

71

ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20050199464 NASA Glenn Research Center, Cleveland, OH, USA

Acoustical Testing Laboratory Developed to Support the Low-Noise Design of Microgravity Space Flight Hardware

Cooper, Beth A.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA John H. Glenn Research Center at Lewis Field has designed and constructed an Acoustical Testing Laboratory to support the low-noise design of microgravity space flight hardware. This new laboratory will provide acoustic emissions testing and noise control services for a variety of customers, particularly for microgravity space flight hardware that must meet International Space Station limits on noise emissions. These limits have been imposed by the space station to support hearing conservation, speech communication, and safety goals as well as to prevent noise-induced vibrations that could impact microgravity research data. The Acoustical Testing Laboratory consists of a 23 by 27 by 20 ft (height) convertible hemi/anechoic chamber and separate sound-attenuating test support enclosure. Absorptive 34-in. fiberglass wedges in the test chamber provide an anechoic environment down to 100 Hz. A spring-isolated floor system affords vibration isolation above 3 Hz. These criteria, along with very low design background levels, will enable the acquisition of accurate and repeatable acoustical measurements on test articles, up to a full space station rack in size, that produce very little noise. Removable floor wedges will allow the test chamber to operate in either a hemi/anechoic or anechoic configuration, depending on the size of the test article and the specific test being conducted. The test support enclosure functions as a control room during normal operations but, alternatively, may be used as a noise-control enclosure for test articles that require the operation of noise-generating test support equipment.

Author

Acoustic Measurement; Acoustic Properties; Low Noise; Microgravity; Test Chambers

20050200879 Naval Postgraduate School, Monterey, CA USA

Undersea Acoustic Propagation Channel Estimation

Dessalermos, Spyridon; Jun. 2005; 142 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435483; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research concerns the continuing development of Seaweb underwater networking. In this type of wireless network the radio channel is replaced by an underwater acoustic channel which is strongly dependent on the physical properties of the ocean medium and its boundaries, the link geometry and the ambient noise. Traditional acoustic communications have involved a priori matching of the signaling parameters (e.g., frequency band, source level, modulation type, coding pulse length) to the expected characteristics of the channel. To achieve more robust communications among the nodes of the acoustic network, as well as high quality of service, it is necessary to develop a type of adaptive modulation in the acoustic network. Part of this process involves estimating the channel scattering function in terms of impulse response, the Doppler effects, and the link margin. That is possible with the use of a known probe signal for analyzing the response of the channel. The estimated channel scattering function can indicate the optimum signaling parameters for the link (adaptive modulation). This approach is also effective for time varying channels, including links between mobile nodes (e.g. two submarines), since the channel characteristics can be updated each time we send a probe signal.

DTIC

Acoustic Propagation; Acoustics; Estimates; Modulation; Sound Transmission; Underwater Communication

20050200897 Naval Postgraduate School, Monterey, CA USA

Vertical Plane Obstacle Avoidance and Control of the REMUS Autonomous Underwater Vehicle Using Forward Look Sonar

Hemminger, Daniel L.; Jun. 2005; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435520; No Copyright; Avail: Defense Technical Information Center (DTIC)

Current rates of technological advancement continue to translate into changes on our battlefields. Aerial robots capable of gathering reconnaissance along with unmanned underwater vehicles capable of defusing enemy minefields provide evidence that machines are playing key roles once played by humans within our military. This thesis explores one of the major problems facing both commercial and military UUVs to date. Successfully navigating in unfamiliar environments and maneuvering autonomously to avoid obstacles is a problem that has yet to be fully solved. Using a simulated 2-D ocean environment, the work of this thesis provides results of numerous REMUS simulations that model the vehicle's flight path over selected sea bottoms. Relying on a combination of sliding mode control and feedforward preview control, REMUS is able to locate obstacles such as seawalls using processed forward look sonar images. Once recognized, REMUS maneuvers to avoid the obstacle according to a Gaussian potential function. In summary, the integration of feedforward preview control and sliding mode control results in an obstacle avoidance controller that is not only robust, but also autonomous.

DTIC

Autonomy; Obstacle Avoidance; Sonar; Underwater Vehicles

20050200921 Naval Postgraduate School, Monterey, CA USA

'Follow the Leader': Formation Control of Multiple Autonomous Vehicles Using Forward Looking Sonar

Grabelle, Jason; Jun. 2005; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435568; No Copyright; Avail: Defense Technical Information Center (DTIC)

With the Global War on Terrorism (GWOT) taking place in full force, autonomous vehicles have become a major asset to government forces. Expansion of single vehicle technology to multiple vehicle technology is required in order for the USA to stay ahead of its adversaries in the GWOT and other technological fields (such as oceanography). Multiple vehicle technology has been explored by many different institutions in the recent past (Leonard, 2001 and Kucik, 2003). Expansion of this technology will lead to greater autonomy and robustness amongst the vehicles. This thesis presents a simulation of a 'follow the leader' behavior for multiple Autonomous Underwater Vehicles (AUVs). The follower vehicle incorporates the use of forward-looking sonar to track the leader vehicle. This process will free up bandwidth between acoustic modems; allowing data transfer to occur with greater efficiency. Hydrodynamic coefficients are used to develop steering equations that model REMUS through a track of specified waypoints similar to a real-world mission track. A two-dimensional forward looking sonar model with a 120 deg horizontal scan and a 110 meter radial range is modeled to track the leader vehicle. Resulting bearing and range between the two vehicles is incorporated as control for positioning the follower vehicle.

DTIC

Autonomous Navigation; Autonomy; Sonar; Underwater Acoustics; Underwater Vehicles

20050200965 Naval Postgraduate School, Monterey, CA USA

USW Area Analogs

Everett, Keith; Jun. 2005; 145 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435656; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of this project is to investigate the feasibility of and methodology for the development of a set of environmental analogs of operational Undersea Warfare (USW) areas within fleet training areas. It is primarily a discussion of the identification of parameters that characterize the tactical USW environment, prioritization of these parameters, identification of existing databases that contain these parameters and an outline of the processes required to extract the desired data from the databases. An example of two operational areas with probable analogous training areas is discussed in terms of the methodology proposed. Among the environmental parameters considered are: bathymetry, sediment type, sound velocity profiles, acoustic response of the environment across a broad frequency spectrum (for both active and passive sonar), ambient noise, shipping density, bioluminescent properties, evaporation duct height, atmospheric surface duct height and gravitational anomalies. The project focus is primarily on acoustic oceanographic features but non-acoustic and atmospheric features are considered. There is an expectation that this project is the starting point for further research, software product development, data extraction, analog identification and promulgation of a tailored product to the fleet. The ultimate goal is to train for USW across the fleet in areas as much like the areas the Navy fights in as possible.

DTIC

Acoustic Properties; Analogs; Warfare

20050201086 Naval Postgraduate School, Monterey, CA USA

Undersea Navigation via a Distributed Acoustic Communications Network

Hahn, Matthew J.; Jun. 2005; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435873; No Copyright; Avail: Defense Technical Information Center (DTIC)

Acoustic modems are the basis for emerging undersea wireless communications networks. US Navy Seaweb technology offers an opportunity to perform undersea navigation and tracking by virtue of node-to-node ranging measurements acquired as a by-product of the acoustic communications protocol. A simple localization algorithm is developed and verified with synthetic data and is then tested with an Unmanned Undersea Vehicle (UUV) during an experiment at sea.

DTIC

Acoustics; Communication; Communication Networks; Navigation; Sound Transmission; Underwater Communication

20050201796 NASA Glenn Research Center, Cleveland, OH, USA

Aeroacoustic Analysis of Fan Noise Reduction With Increased Bypass Nozzle Area

Woodward, Richard P.; Hughes, Christopher E.; Podboy, Gary G.; July 2005; 33 pp.; In English; 11th Aeroacoustics Conference cosponsored by the American Institute of Aeronautics and Astronautics and the Confederation of European Aerospace Societies, 23-25 May 2005, Monterey, CA, USA

Contract(s)/Grant(s): WBS 22-781-30-58

Report No.(s): NASA/TM-2005-213825; E-15184; AIAA Paper 2005-3075; No Copyright; Avail: CASI; [A03](#), Hardcopy

An advanced model turbofan was tested in the NASA Glenn 9-by 15-Foot Low Speed Wind Tunnel (9x15 LSWT) to explore far field acoustic effects of increased bypass nozzle area. This fan stage test was part of the NASA Glenn Fan Broadband Source Diagnostic Test, second entry (SDT2) which acquired aeroacoustic results over a range of test conditions. The baseline nozzle was sized to produce maximum stage performance at cruise condition. However, the wind tunnel testing is conducted near sea level condition. Therefore, in order to simulate and obtain performance at other operating conditions, two additional nozzles were designed and tested one with +5 percent increase in weight flow (+5.4 percent increase in nozzle area compared with the baseline nozzle), sized to simulate the performance at the stage design point (takeoff) condition, and the other with a +7.5 percent increase in weight flow (+10.9 percent increase in nozzle area) sized for maximum weight flow with a fixed nozzle at sea level condition. Measured acoustic benefits with increased nozzle area were very encouraging, showing overall sound power level (OAPWL) reductions of 2 or more dB while the stage thrust actually increased by 2 to 3 percent except for the most open nozzle at takeoff rotor speed where stage performance decreased. Effective perceived noise levels for a 1500 ft engine flyover and 3.35 scale factor showed a similar noise reduction of 2 or more EPNdB. Noise reductions, principally in the level of broadband noise, were observed everywhere in the far field. Laser Doppler Velocimetry measurements taken downstream of the rotor showed that the total turbulent velocity decreased with increasing nozzle flow, which may explain the reduced rotor broadband noise levels.

Author

Aeroacoustics; Fan Blades; Low Speed Wind Tunnels; Nozzle Flow; Wind Tunnel Tests; Noise Reduction; Aircraft Engines; Bypasses; Nozzle Design

20050202083 NASA Glenn Research Center, Cleveland, OH, USA

New Fan Engine Noise-Reduction Concept Using Trailing Edge Blowing of Fan Blades Demonstrated

Heidelberg, Laurence J.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A major source of noise in commercial turbofan engines is the interaction of the fan blade wakes with the fan exit vanes (stators). These wakes can be greatly reduced by filling them with air blown out of the blade trailing edge. Extensive testing of this concept has demonstrated significant noise reductions. These tests were conducted on a low-speed, 4-ft-diameter fan using hollow blades at NASA Glenn Research Center's Aeroacoustic Propulsion Laboratory (AAPL).

Derived from text

Fan Blades; Turbofan Engines; Noise Reduction; Aerodynamic Noise

20050203657 NASA Glenn Research Center, Cleveland, OH, USA

Signal Processing Variables for Optimization of Flaw Detection in Composites Using Ultrasonic Guided Wave Scanning

Roth, Don J.; Cosgriff, Laura M.; Martin, Richard E.; Teemer, LeTarrie; [2004]; 1 pp.; In English; 31st Annual Review of Progress in Quantitative Nondestructive Evaluation, 25-30 Jul. 2004, Golden, CO, USA

Contract(s)/Grant(s): NAS3-2383; No Copyright; Avail: Other Sources; Abstract Only

This study analyzes the effect of signal processing variables on the ability of the ultrasonic guided wave scan method at NASA Glenn Research Center to distinguish various flaw conditions in ceramic matrix composites samples. In the ultrasonic guided wave scan method, several time- and frequency-domain parameters are calculated from the ultrasonic guided wave signal at each scan location to form images. The parameters include power spectral density, centroid mean time, total energy (zeroth moment), centroid frequency, and ultrasonic decay rate. A number of signal processing variables are available to the user when calculating these parameters. These signal processing variables include 1) the time portion of the time-domain waveform processed, 2) integration type for the properties requiring integrations, 3) bounded versus unbounded integrations, 4) power spectral density window type, 5) and the number of time segments chosen if using the short-time fourier transform to calculate ultrasonic decay rate. Flaw conditions examined included delamination, cracking, and density variation.

Author

Signal Processing; Ultrasonic Radiation; Optimization; Nondestructive Tests; Ceramic Matrix Composites

20050203834 Florida State Univ., Tallahassee, FL, USA

Development of New String-Instruments of the Violin-Family and Guitar-Family via Engineering Physics and Computer Resolved Harmonic Spectral Intensities

Kasha, Michael; Phipps, Thomas H.; Sanu, Dapo; Moussa, Ahmed S.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 3 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hearing virtuoso performers play the beautiful instruments produced by the famous craftsmen of yore would not seem to leave much room for significant advancement in design. Yet, in general, the mechanical structures which evolved have critical functioning components which arose accidentally, and before the development of theoretical physical mechanics. Analyzing the structures by the theory of plate harmonics, both the frequency dependence on physical variables, as well as the implications of the Bessel function components, and also the variables affecting the mechanical impedance - all these lead to radically different mechanical (internal) designs. The bass-bar and sound-post constitute the main focal points of the present research. These components are the critical structural elements in the transmission of the bowed-string vibrational energy to the top-plate (the soundboard), which is the principal transducer of vibrational to acoustical energy. Working with virtuoso builders and virtuoso musicians, using instruments of such novel design, and recording the output audio-spectral display for tonal brilliance by the Backhaus criterion, has led to dramatic positive enhancement of tone-color and expressiveness.

Author

Sound Waves; Harmonics; Bessel Functions; Mechanical Impedance; Music; Frequencies

20050203867 Alabama Univ., Huntsville, AL, USA

On the Interaction of a Premixed Flame with an Acoustic Disturbance

Hood, Caroline; Frendi, Abdelkader; June 14, 2005; 10 pp.; In English; AIAA 41st Joint Propulsion Conference and Exhibit, 10-14 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NCC8-200

Report No.(s): AIAA Paper 2005-4304; No Copyright; Avail: CASI; [A02](#), Hardcopy

The main objective of this research is to analyze the effect of acoustic disturbances on a premixed flame and determine their role in the onset of combustion instabilities. Computations for the one-dimensional, unsteady combustion of a lean premixed methane-air mixture are performed. An acoustic excitation is introduced in the chamber and interacts with the flame front. Our results indicate that as the amplitude of the acoustic excitation is increased, the flame front position fluctuates rapidly. This phenomenon is even more intense when the frequency of the acoustic disturbance matches the fundamental frequency of the chamber. Our results suggest that the interactions between the flame and the acoustic excitation may result in flame extinguishment. In addition various passive control devices are tested and we found that the Helmholtz resonator with rounded inlet corners is the most efficient.

Author

Acoustic Excitation; Premixed Flames; Combustion Stability; Mathematical Models

20050203872 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands

Sensitivity of Propagation Loss to Wind Speed: Comparison of REACT, FELMODE and INSIGHT Model Predictions with OASES Reference Solutions

Ainslie, M. A.; Boek, W.; March 2005; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): B01/KM/948; TNO Proj, 015.31986

Report No.(s): TD-2005-0295; TNO-DV1-2005-A014; Copyright; Avail: Other Sources

It is known that different sonar performance models such as ALMOST and INSIGHT sometimes make different performance predictions for essentially the same situation. Part of the reason for this is the different manner in which sea surface interactions are modelled. Propagation loss calculations by the models ALMOST, FELMODE and INSIGHT are compared with reference solutions calculated using OASES. It is shown that the most important differences in propagation loss disappear after making some minor corrections to ALMOST and FELMODE.

Author

Performance Prediction; Sonar; Underwater Acoustics; Acoustic Propagation; Losses; Wind Velocity; Sea Roughness; Ocean Surface; Air Water Interactions

20050203876 NASA Glenn Research Center, Cleveland, OH, USA

Aeroacoustic Flow Phenomena Accurately Captured by New Computational Fluid Dynamics Method

Blech, Richard A.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

One of the challenges in the computational fluid dynamics area is the accurate calculation of aeroacoustic phenomena, especially in the presence of shock waves. One such phenomenon is 'transonic resonance,' where an unsteady shock wave at the throat of a convergent-divergent nozzle results in the emission of acoustic tones. The space-time Conservation-Element and Solution-Element (CE/SE) method developed at the NASA Glenn Research Center can faithfully capture the shock waves, their unsteady motion, and the generated acoustic tones. The CE/SE method is a revolutionary new approach to the numerical modeling of physical phenomena where features with steep gradients (e.g., shock waves, phase transition, etc.) must coexist with those having weaker variations. The CE/SE method does not require the complex interpolation procedures (that allow for the possibility of a shock between grid cells) used by many other methods to transfer information between grid cells. These interpolation procedures can add too much numerical dissipation to the solution process. Thus, while shocks are resolved, weaker waves, such as acoustic waves, are washed out.

Author

Aeroacoustics; Computational Fluid Dynamics; Mathematical Models; Sound Waves

20050203887 NASA Glenn Research Center, Cleveland, OH, USA

Auditory Demonstrations II: Challenges to Speech Communication and Music Listening

Cooper, Beth A.; Nelson, David A.; Danielson, Richard W.; [2004]; 1 pp.; In English; Noise Con 2004, 12-14 Jul. 2004, Baltimore, MD, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center Acoustical Testing Laboratory has produced a compact disc with collection of auditory demonstrations that illustrate the impact of acoustical conditions and hearing loss on everyday listening situations. These demonstrations illustrate both the need for, and the benefits of, noise control efforts in a wide range of situations where good speech intelligibility is desirable. Although Auditory Demonstrations II was developed primarily as a vehicle to further low-noise advocacy within NASA's space flight (and ground-support) programs, it was designed to have broad applicability in the larger technical community. For example, engineers, architects, policymakers, and health care professionals could use

these demonstrations to experience and tangibly gauge the true cost of communication interference due to noise and hearing loss. In addition to the communication demonstrations, the disc includes recordings of several styles of music that have been modified to demonstrate auditory changes due to progressive noise-related hearing loss. This presentation will discuss potential applications and outcomes of these demonstrations in support of noise control and hearing loss prevention initiatives. Single copies of the demonstration disc may be requested at the Acoustical Testing Laboratory web site at <http://acousticaltest.grc.nasa.gov>.

Author

Music; Auditory Defects; Hearing; Auditory Tasks; Speech; Voice Communication

72

ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 *Nuclear Physics*.

20050199757 Lawrence Livermore National Lab., Livermore, CA USA

NASA Participated in the Japan 2001 Science, Creativity and the Young Mind Workshop

Landa, A.; Soderlind, P.; Ruban, A.; Nov. 18, 2003; 12 pp.; In English

Report No.(s): DE2005-15013635; UCRL-CONF-201027; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

Electronic Structure; Plutonium Alloys

20050201612 Virginia Univ., Charlottesville, VA USA

Structure and Dynamics of Excited Atoms

Gallagher, Thomas F.; Jan. 2005; 13 pp.; In English

Contract(s)/Grant(s): FA49620-02-1-0054; Proj-2301

Report No.(s): AD-A435243; AFRL-SR-AR-TR-05-0261; No Copyright; Avail: CASI; [A03](#), Hardcopy

We have now developed the laser technology to excite Rydberg atoms in the trap using a pulsed amplified cw laser. With this system we can produce samples with only 10% fluctuation in the number of Rydberg atoms. This stability is crucial in studying the processes of interest, which always involve interactions among Rydberg atoms and are thus non linear, often highly so, in the density. We have developed millimeter (mm) wave techniques to probe and manipulate the cold Rydberg samples. As will be described below we are able to use the high spectral resolution to observe line broadening, and we have been able to change the macroscopic properties of the sample by changing the quantum state of 10% of the Rydberg atoms. We have not yet done much to control the geometry of the sample, but it is becoming clear that this is an interesting direction to explore.

DTIC

Atoms; Pulsed Lasers; Stability

20050203871 Ohio Aerospace Inst., OH, USA, NASA Glenn Research Center, Cleveland, OH, USA

Atomistic Modeling of Semiconductors: Si, C, and 3C-SiC

Bozzolo, Guillermo; Garcés, Jorge E.; Abel, Phillip B.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

An ongoing task of the Computational Materials Group (CMG) at the NASA Glenn Research Center is to enhance the role of atomistic simulations based on quantum-approximate methods in the study of new materials and their properties. One of the main goals of the activity continues to be breaching limitations that arise from the natural balance between accuracy, range of application, and computational simplicity. Whether that balance can be maintained while breaking new ground depends on the methods available with a minimum of constraints and limitations for the study of the energetics of arbitrary systems. The main tool used in CMG research, the Bozzolo- Ferrante-Smith (BFS) method for alloys, has no inherent constraint in its formulation, a feature that has allowed for successful research on various topics. In this article, we report on the latest development of the CMG program, namely, the extension and application of the BFS method to compound semiconductors, a departure from our previous research based primarily on metallic alloys.

Author

Semiconductors (Materials); Silicon; Carbon; Atoms; Models

74 OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20050199451 NASA Glenn Research Center, Cleveland, OH, USA

Diffusivity Measurements Made Instant and Easy

Rashidnia, Nasser; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

A compact common path interferometer (CPI) system has been developed to measure the diffusivity of liquid pairs. The CPI is an optical technique that can be used to measure changes in the gradient of the refraction index of transparent materials. It uses a shearing interferometer that shares the same optical path from a laser light source to the final imaging plane. The molecular diffusion coefficient of liquids can be determined from the physical relations between changes in the optical path length and liquid phase properties. When the data obtained by using the CPI have been compared with similar results from other techniques, the instrument has been demonstrated to be far superior to other instruments for measuring the diffusivity of miscible liquids while staying very compact and robust (ref. 1). Because of its compactness and ease of use, the CPI has been adopted for use in studies of interface dynamics as well as other diffusion-controlled process applications (ref. 2). This progress will permit experiments in microgravity that can quantitatively answer basic science questions about mass and thermal diffusion and their effect in transport processes. This instrument is a spinoff of a diagnostic development for microgravity fluid physics experiments at the NASA Glenn Research Center that has used optics and electronics existing in the fluid physics laboratory for feasibility studies. Optical diagnostic techniques have become an integral part of many areas of measurement applications in industrial and research laboratories. Many types of interferometers and their phase-shifted versions have been used as instruments for measuring optical wave fronts for lens testing and combustion and fluid flow diagnostics. One of these, the point diffraction interferometer, is considered to be robust (see, for example, ref. 3) because it has a common-path design. The point diffraction interferometer is difficult to align and has a limited measurement range for liquid-phase applications. Interferometry and schlieren techniques have been widely used for many years for gas-flow-visualization. On the other hand, the CPI, which is basically a Wollaston prism Polarizer in combination with an analyser (crystalline quartz retardation plate) is used instead of a point diffraction interferometer unit. The advantage of using the CPI over other optical techniques is that it can make quantitative measurements in liquids with the large index of refraction variations that often occur in interface dynamics studies. This can be simply accomplished by using different prism polarizers for each particular experimental condition.

Author

Interferometry; Diffusivity; Liquid Phases; Refractivity; Optical Paths; Microgravity; Thermal Diffusion

20050199453 NASA Glenn Research Center, Cleveland, OH, USA, DYNACS Engineering Co., Inc., USA, Federal Data Corp., USA

Light Microscopy Module: An On-Orbit Microscope Planned for the Fluids and Combustion Facility on the International Space Station

Doherty, Michael P.; Motil, Susan M.; Snead, John H.; Griffin, DeVon W.; Research and Technology 2000; March 2001; 3 pp.; In English

Contract(s)/Grant(s): NAS3-99155; NAS3-98008; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Light Microscopy Module (LMM) is planned as a fully remotely controllable on-orbit microscope subrack facility, allowing flexible scheduling and control of fluids and biology experiments within NASA Glenn Research Center's Fluids and Combustion Facility on the International Space Station. Within the Fluids and Combustion Facility, four fluids physics experiments will utilize an instrument built around a light microscope. These experiments are the Constrained Vapor Bubble experiment (Peter C. Wayner of Rensselaer Polytechnic Institute), the Physics of Hard Spheres Experiment-2 (Paul M. Chaikin of Princeton University), the Physics of Colloids in Space-2 experiment (David A. Weitz of Harvard University), and the Low Volume Fraction Colloidal Assembly experiment (Arjun G. Yodh of the University of Pennsylvania). The first experiment investigates heat conductance in microgravity as a function of liquid volume and heat flow rate to determine, in detail, the transport process characteristics in a curved liquid film. The other three experiments investigate various complementary aspects of the nucleation, growth, structure, and properties of colloidal crystals in microgravity and the effects of micromanipulation upon their properties. Key diagnostic capabilities for meeting the science requirements of the four experiments include video microscopy to observe sample features including basic structures and dynamics, interferometry to measure vapor bubble thin film thickness, laser tweezers for colloidal particle manipulation and patterning, confocal

microscopy to provide enhanced three-dimensional visualization of colloidal structures, and spectrophotometry to measure colloidal crystal photonic properties.

Author

Microscopy; Spaceborne Experiments; Combustion Chambers; Heat Transmission; Microgravity

20050199455 NASA Glenn Research Center, Cleveland, OH, USA

Compact Microscope Imaging System Developed

McDowell, Mark; Research and Technology 2000; March 2001; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Compact Microscope Imaging System (CMIS) is a diagnostic tool with intelligent controls for use in space, industrial, medical, and security applications. The CMIS can be used in situ with a minimum amount of user intervention. This system, which was developed at the NASA Glenn Research Center, can scan, find areas of interest, focus, and acquire images automatically. Large numbers of multiple cell experiments require microscopy for in situ observations; this is only feasible with compact microscope systems. CMIS is a miniature machine vision system that combines intelligent image processing with remote control capabilities. The software also has a user-friendly interface that can be used independently of the hardware for post-experiment analysis. CMIS has potential commercial uses in the automated online inspection of precision parts, medical imaging, security industry (examination of currency in automated teller machines and fingerprint identification in secure entry locks), environmental industry (automated examination of soil/water samples), biomedical field (automated blood/cell analysis), and microscopy community. CMIS will improve research in several ways: It will expand the capabilities of MSD experiments utilizing microscope technology. It may be used in lunar and Martian experiments (Rover Robot). Because of its reduced size, it will enable experiments that were not feasible previously. It may be incorporated into existing shuttle orbiter and space station experiments, including glove-box-sized experiments as well as ground-based experiments.

Author

Computer Vision; Image Processing; Microscopes; Miniaturization

20050199737 Lawrence Livermore National Lab., Livermore, CA USA

Diode-Pumped Solid State Lasers for Inertial Fusion Energy

Payne, S. A.; Bibeau, C.; Beach, R. J.; Bayramian, A.; Chanteloup, J. C.; Nov. 15, 1999; 12 pp.; In English

Report No.(s): DE2005-15013230; UCRL-JC-136601; No Copyright; Avail: Department of Energy Information Bridge

We have begun building the Mercury laser system as the first in a series of new generation diode-pumped solid-state lasers for inertial fusion research. Mercury will integrate three key technologies: diodes, crystals, and gas cooling, within a unique laser architecture that is scalable to kilojoule and megajoule energy levels for fusion energy applications. The primary near-term performance goals include 10% electrical efficiencies at 10 Hz and 100J with a 2-10 ns pulse length at 1.047 μm wavelength. When completed, Mercury will allow rep-rated target experiments with multiple chambers for high energy density physics research.

NTIS

Diodes; Fusion Reactors; Laser Fusion; Solid State Lasers

20050199739 Lawrence Livermore National Lab., Livermore, CA USA

Growth of Laser Initiated Damage in Fused Silica at 351nm

Norton, M. A.; Hrubesh, L. W.; Wu, Z.; Donohue, E. E.; Feit, M. R.; Jan. 30, 2001; 12 pp.; In English

Report No.(s): DE2005-15013162; UCRL-JC-139624; No Copyright; Avail: Department of Energy Information Bridge

The lifetime of optics in high-fluence UV laser applications is typically limited by the initiation of damage and its subsequent growth. We have measured the growth rate of laser-induced damage on fused silica surfaces in both air and vacuum. The data shows exponential growth in the lateral size of the damage site with shot number above a threshold fluence. The concurrent growth in depth follows a linear dependence with shot number. The size of the initial damage influences the threshold for growth; the morphology of the initial site depends strongly on the initiating fluence. We have found only a weak dependence on pulse length for growth rate. Most of the work has been on bare substrates but the presence of a sol-gel AR coating has no significant effect.

NTIS

Damage; Laser Damage; Lasers; Silica Glass; Silicon Dioxide

20050201003 Michigan Univ., Ann Arbor, MI USA

Optically Controlled Quantum Dots for Quantum Computing

Steel, Duncan G.; Sham, Lu J.; Apr. 2005; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0478

Report No.(s): AD-A435727; ARO-42378.18-PH-QC; No Copyright; Avail: Defense Technical Information Center (DTIC)

This program conducted experimental & theoretical research aimed at developing an optically driven quantum dot quantum computer. In addition to the 2 %PI's, the work was done in collaboration with Dan Gammon at the Naval Research laboratory. D. Gammon had responsibility for growing & characterizing the material, U Sham is responsible for theoretical support & concept development & DG Steel is responsible for experimental demonstration of key experimental demonstrations for quantum computing. Key ideas have now been tested & verified on this system, including demonstration of a quantum controlled-NOT gate & a theoretical proposal to use pulse-shaping to reduce unintended dynamics leading to errors & to increase computation speed. For scalable quantum computation, the qubit for this system is the optically controlled electron spin vector. Initial experiments have now been completed demonstrating that we produce single charged quantum dots (Gammon at NRL), & that we can optically control & manipulate these states. A lower limit on the decoherence rate has also been determine.

DTIC

Optical Properties; Quantum Computation; Quantum Dots; Quantum Theory

20050201082 Pennsylvania Univ., Philadelphia, PA USA

Bio-Inspired Sensing and Display of Polarization Imagery

Engheta, Nader; Pugh, Edward N., Jr; Jul. 2005; 117 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0140

Report No.(s): AD-A435868; AFRL-SR-AR-TR-05-0304; No Copyright; Avail: CASI; [A06](#), Hardcopy

During our research efforts on this program, we have introduced, developed, and studied various imaging algorithms, sensing schemes and visualization and display methodologies inspired and informed by biological consideration, and have demonstrated that these bio-inspired polarization sensing and imaging techniques enable us to achieve better target detection, enhanced visibility in otherwise low-contrast conditions, longer detection range in optically scattering media, man-made polarization-sensing adaptation based on changing environments, surface deformation/variation detection (e.g., detection of finger prints on a smooth surface using polarization-based vision), 'shadow removal' by displaying polarization information instead of conventional intensity information, and many more novel outcomes. These results have shown the numerous possibilities and potential applications of these bio-inspired methods in various sensing, imaging, and display technologies. We have also explored several ideas for mapping polarization information onto visual cues suitable for observers, including using pseudocolor mapping, static and dynamic textures with varying in orientations, flickering and modulating luminance and/or color contrast of scenes in terms of certain aspects of polarization values, and fusing polarization information into optical imagery. Our efforts have shown that the polarization can bring another 'dimension' of information into the domain of imaging and sensing for detection, visibility enhancement, and display methodologies.

DTIC

Detection; Imagery; Images; Io; Target Acquisition

20050201940 Lawrence Livermore National Lab., Livermore, CA USA

Intracavity Adaptive Correction of a 10kW, Solid-State, Heat-Capacity Laser

LaFortune, K. N.; Hurd, R. L.; Johansson, E. M.; Fochs, D. S.; Jan. 13, 2004; 14 pp.; In English

Report No.(s): DE2005-15013717; UCRL-PROC-201816; No Copyright; Avail: Department of Energy Information Bridge

The Solid-State, Heat-Capacity Laser (SSHCL), under development at Lawrence Livermore National Laboratory is a large aperture, confocal, unstable resonator requiring near-diffraction-limited beam quality. There are two primary sources of the aberrations in the system: residual, static aberrations from the fabrication of the optical components and predictable, time-dependent, thermally-induced index gradients within the gain medium. A deformable mirror placed within the cavity is used to correct the aberrations that are sensed externally with a Shack-Hartmann wavefront sensor. Although it is more challenging than external correction, intracavity correction enables control of the mode growth within the resonator, resulting in the ability to correct a more aberrated system longer. The overall system design, measurement techniques and correction algorithms are discussed. Experimental results from initial correction of the static aberrations and dynamic correction of the time-dependent aberrations are presented.

NTIS

Lasers; Solid State; Solid State Lasers; Specific Heat

20050201989 Lawrence Livermore National Lab., Livermore, CA USA

National Ignition Facility Target Chamber

Wavrik, R. W.; Cox, J. R.; Fleming, P. J.; Oct. 05, 2005; 14 pp.; In English

Report No.(s): DE2005-15013138; UCRL-JC-141053; No Copyright; Avail: Department of Energy Information Bridge

On June 11, 1999 the Department of Energy dedicated the single largest piece of the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) in Livermore, California. The ten (10) meter diameter aluminum target high vacuum chamber will serve as the working end of the largest laser in the world. The output of 192 laser beams will converge at the precise center of the chamber. The laser beams will enter the chamber in two by two arrays to illuminate 10 millimeter long gold cylinders called hohlraums enclosing 2 millimeter capsule containing deuterium, tritium and isotopes of hydrogen. The two isotopes will fuse, thereby creating temperatures and pressures resembling those found only inside stars and in detonated nuclear weapons, but on a minute scale. The NIF Project will serve as an essential facility to insure safety and reliability of our nation's nuclear arsenal as well as demonstrating inertial fusion's contribution to creating electrical power. The paper will discuss the requirements that had to be addressed during the design, fabrication and testing of the target chamber.

NTIS

Ignition; Lasers; Targets

20050202008 Lawrence Livermore National Lab., Livermore, CA USA

Fast Wavefront Reconstruction in Large Adaptive Optics Systems Using the Fourier Transform

Poyneer, L. A.; Gavel, D. T.; Brase, J. M.; Mar. 13, 2002; 24 pp.; In English

Report No.(s): DE2005-15013348; UCRL-JC-147058; No Copyright; Avail: Department of Energy Information Bridge

Wavefront Reconstruction using the Fast Fourier Transform and spatial filtering is shown to be computationally tractable and sufficiently accurate for use in large Shack Hartmann-based adaptive optics systems (up to at least 10,000 actuators). This method is significantly faster and can have lower noise propagation than traditional VMM reconstructors. The boundary problem which prevented the accurate reconstruction of phase in circular apertures using square-grid FTs is identified and solved. The methods are adapted for use on the Fried-geometry. Detailed performance analysis of mean squared error and noise propagation for FT methods is presented, using both theory and simulation.

NTIS

Adaptive Optics; Fourier Transformation; Wave Front Reconstruction; Wave Fronts

20050203903 Purdue Univ., West Lafayette, IN, USA

Inquiry-Based Learning by Students with Disabilities Using RemoteScope: An Internet-Driven Digital Light Microscope

Duerstock, Bradley; Robinson, J. Paul; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Physical access to classrooms and laboratories is important, but active participation of students with disabilities is paramount for learning. For a comprehensive educational experience, there needs to be interactions between students with disabilities and their teacher and classmates, as well as the course material and laboratory equipment. Inquiry-based learning is recommended as a standard of teaching science to all students at multiple grade levels. This pedagogical approach encourages students to actively explore and interact with scientific concepts and phenomena in order to gain a more thorough understanding. Learning science is something that students do, not something that is done to them. (National Research Council, 1996) However, physical disabilities require us to consider a significantly different approach because their disabilities prevent many students from taking a traditionally active part in classroom demonstrations and to perform laboratory experiments. These physical obstacles prevent students with disabilities to achieve their full potential by hindering them from enjoying the same educational experiences that able-bodied students have when learning science. The science, engineering, and technology fields intrinsically require significant amounts of laboratory practice and equipment usage, which can create a serious impasse to students with disabilities. The participation of students with disabilities in secondary and post-secondary science education is very low compared to their able-bodied classmates and other minority groups. We believe methods that promote universal access in the laboratory environment would not only, permit students with disabilities physical accommodation but also would be essential in the educational development of students in science. While this may not be a practical desire for making all areas of science totally accessible, there are some that can be made accessible in a real and meaningful way. Scientific learning frequently depends on being able to physically manipulate laboratory equipment for

deeper understanding of scientific methodology and the limits of the tool. This ability to personally ‘do’ the science is an often an imperative for true understanding. As secondary and college students with disabilities confront a lack of specialized assistive technology (AT) equipment in laboratory-oriented courses, many will be dissuaded from pursuing science majors and consequentially careers in science.

Author

Optical Microscopes; Training Devices; Visual Aids; Disabilities; Education; Laboratory Equipment

20050203992 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Optical Diagnostic Methods for Describing Fuel Injection and Combustion Flowfield Phenomena

Locke, Randy J.; Hicks, Yolanda R.; Anderson, Robert C.; [2004]; 2 pp.; In English; Great Lakes Photonics Symposium, 7-11 Jun. 2004, Cleveland, OH, USA

Contract(s)/Grant(s): WBS 22-714-20-05; No Copyright; Avail: Other Sources; Abstract Only

Over the past decade advanced optical diagnostic techniques have evolved and matured to a point where they are now widely applied in the interrogation of high pressure combustor flows. At NASA Glenn Research Center (GRC), imaging techniques have been used successfully in on-going work to develop the next generation of commercial aircraft gas turbine combustors. This work has centered on providing a means by which researchers and designers can obtain direct visual observation and measurements of the fuel injection/mixing/combustion processes and combustor flowfield in two- and three-dimensional views at actual operational conditions. Obtaining a thorough understanding of the chemical and physical processes at the extreme operating conditions of the next generation of combustors is critical to reducing emissions and increasing fuel efficiency. To accomplish this and other tasks, the diagnostic team at GRC has designed and constructed optically accessible, high pressure high temperature flame tubes and sector rigs capable of optically probing the 20-60 atm flowfields of these aero-combustors. Among the techniques employed at GRC are planar laser-induced fluorescence (PLIF) for imaging molecular species as well as liquid and gaseous fuel; planar light scattering (PLS) for imaging fuel sprays and droplets; and spontaneous Raman scattering for species and temperature measurement. Using these techniques, optical measurements never before possible have been made in the actual environments of liquid fueled gas turbines. 2-D mapping of such parameters as species (e.g. OH-, NO and kerosene-based jet fuel) distribution, injector spray angle, and fuel/air distribution are just some of the measurements that are now routinely made. Optical imaging has also provided prompt feedback to researchers regarding the effects of changes in the fuel injector configuration on both combustor performance and flowfield character. Several injector design modifications and improvements have resulted from this feedback. Alternate diagnostic methods are constantly being evaluated as to their suitability as a diagnostic tool in these environments. A new method currently under examination is background oriented Schlieren (BOS) for examining the fuel/air mixing processes. While ratioing the Stokes and anti-Stokes nitrogen lines obtained from spontaneous Raman is being refined for temperature measurement. While the primary focus of the GRC diagnostic work remains optical species measurement and flow stream characterization, an increased emphasis has been placed on our involvement in flame code validation efforts. A functional combustor code should shorten and streamline future combustor design. Quantitative measurements of flow parameters such as temperature, species concentration, drop size and velocity using such methods as Raman and phase Doppler anemometry will provide data necessary in this effort.

Author

Combustion Physics; Fuel Injection; Flow Distribution; Optics

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20050199662 Princeton Univ., NJ USA

Transition from Thermally-Driven to Ponderomotively-Driven Stimulated Brillouin Scattering and Filamentation of Light in Plasma

Berger, R. L.; Valeo, E. J.; Brunner, S.; Apr. 2005; 30 pp.; In English

Report No.(s): DE2005-838510; PPPL-4061; No Copyright; Avail: Department of Energy Information Bridge

The dispersion properties of ion acoustic waves and their nonlinear coupling to light waves through ponderomotive and thermal forces are sensitive to the strength of electron-ion collisions. Here, we consider the growth rate of stimulated Brillouin scattering (SBS) when the driven acoustic wave frequency and wavelength span the range of small to large compared to

electron-ion collision frequency and mean free path respectively. We find in all cases the thermal contributions to the SBS growth rate are insignificant if the ion acoustic wave frequency is greater than the electron-ion collision frequency and the wavelength is much shorter than the electron-ion mean free path. On the other hand, the purely growing filamentation instability remains thermally driven for shorter wavelengths than SBS even when the growth rate is larger than the acoustic frequency.

NTIS

Brillouin Effect; Laser Plasma Interactions; Light Scattering; Plasmas (Physics); Wave Interaction

20050199667 Princeton Univ., NJ USA

Low-Noise Collision Operators for Particle-in-Cell Simulations

Lewandowski, J. L. V.; Mar. 2005; 40 pp.; In English

Report No.(s): DE2005-837853; PPPL-4056; No Copyright; Avail: Department of Energy Information Bridge

A new method to implement low-noise collision operators in particle-in-cell simulations is presented. The method is based on the fact that relevant collision operators can be included naturally in the Lagrangian formulation that exemplifies the particle-in-cell simulation method. Numerical simulations show that the momentum and energy conservation properties of the simulated plasma associated with the low-noise collision operator are improved as compared with standard collision algorithms based on random numbers.

NTIS

Collisional Plasmas; Collisions; Low Noise; Simulation

20050199677 Minnesota Univ., Minneapolis, MN, USA

Kinetics of Electron Fluxes in Low-Pressure Nonthermal Plasmas

January 2004; 10 pp.; In English

Report No.(s): DE2005-835052; No Copyright; Avail: Department of Energy Information Bridge

This grant has focused on the study of several aspects of electron kinetics in low pressure plasmas. Entirely new effects arise from the fact that the electron kinetics is governed by non-local effects, in which the electron distribution function is not equilibrium with the local electric field but is governed by spatial transport effects. In this grant, we were able to demonstrate several previously un-studied effects which are a direct result of the nonlocal transport. These are: (1) The existence of a convective cell in electron phase space. The phenomenon was observed and studied in CW plasma conditions. (2) The occurrence of non-collisional cooling of electrons through an effect known as diffusive cooling.

NTIS

Electron Plasma; Kinetics; Low Pressure; Plasmas (Physics)

20050199738 Lawrence Livermore National Lab., Livermore, CA USA

Optimizing Data Recording for the NIF Core Diagnostic X-ray Streak Camera

Kalantar, D. H.; Bell, P. M.; Perry, T. S.; Sewall, N.; Diamond, C.; Jun. 13, 2000; 14 pp.; In English

Report No.(s): DE2005-15013186; UCRL-JC-138107; No Copyright; Avail: Department of Energy Information Bridge

The x-ray streak camera is an important instrument for recording a continuous time history of x-ray emitted from laser target experiments. X-ray streak cameras were used to diagnose experiments in inertially confined fusion and high energy density sciences on the Nova laser. These streak cameras are now used for similar experiments conducted at the OMEGA laser facility, and cameras of this type will be used for experiments on the National Ignition Facility (NIF).

NTIS

Data Recording; Laser Plasmas; Laser Targets; Streak Cameras; X Ray Analysis

20050201934 Lawrence Livermore National Lab., Livermore, CA USA

SYMTRAN-A Time-dependent Symmetric Tandem Mirror Transport Code

Hua, D. D.; Fowler, T. K.; Jun. 14, 2004; 128 pp.; In English

Report No.(s): DE2005-15014290; UCRL-TR-204783; No Copyright; Avail: Department of Energy Information Bridge

A time-dependent version of the steady-state radial transport model in symmetric tandem mirrors has been coded up and first tests performed. Our code, named SYMTRAN, is an adaptation of the earlier SPHERE code for spheromaks, now modified for tandem mirror physics. Motivated by Post's new concept of kinetic stabilization of symmetric mirrors, it is an extension of the earlier TAMRAC rate-equation code omitting radial transport, which successfully accounted for experimental results in TMX. The SYMTRAN code differs from the earlier tandem mirror radial transport code TMT in that our code is

focused on axisymmetric tandem mirrors and classical diffusion, whereas TMT emphasized non-ambipolar transport in TMX and MFTF-B due to yin-yang plugs and non-symmetric transitions between the plugs and axisymmetric center cell. Both codes exhibit interesting but different non-linear behavior. While pulsed operating scenarios may be of interest, we have first focused on achieving a steady state reactor.

NTIS

Symmetry; Tandem Mirrors; Time Dependence

20050201999 Lawrence Livermore National Lab., Livermore, CA USA

Edge-Plasma Properties in Liquid-Wall Environments

Rognlien, T. D.; Rensink, M. E.; Brooks, J. N.; Sep. 07, 2001; 12 pp.; In English

Report No.(s): DE2005-15013410; UCRL-JC-143592; No Copyright; Avail: Department of Energy Information Bridge

Flowing liquid walls have been proposed as the first wall and/or divertor plates for magnetic fusion energy devices because they may solve a number of technological problems for fusion power plants. A key question for their successful use is the edge-plasma shielding of wall-vapor impurities from the core plasma. A self-consistent analysis of the combined hydrogen/impurity edge plasmas for distributed wall impurity sources is performed using the two-dimension fluid transport code UEDGE for tokamak parameters.

NTIS

Liquids; Plasma Density; Plasmas (Physics); Tokamak Devices; Walls

20050202006 Lawrence Livermore National Lab., Livermore, CA USA

Nuclear Diagnostics of ICF

Izumi, N.; Lerche, R. A.; Moran, M. J.; Phillips, T. W.; Sangster, T. C.; Oct. 18, 2001; 14 pp.; In English

Report No.(s): DE2005-15013377; UCRL-JC-14432; No Copyright; Avail: Department of Energy Information Bridge

In inertial confinement fusion (ICF), a high temperature and high density plasma is produced by the spherical implosion of a small capsule. A spherical target capsule is irradiated uniformly by a laser beam or x-rays from a high Z enclosure that is irradiated by laser or ion beams. Then high-pressure ablation of the surface causes the fuel to be accelerated inward. Thermonuclear fusion reactions begin in the center region of the capsule as it is heated to sufficient temperature by the converging shocks.

NTIS

Confinement; Diagnosis; Fusion Reactors; Inertial Confinement Fusion; Laser Fusion; Plasma Diagnostics

20050203850 Wright State Univ., Dayton, OH, USA

Computational Model Tracking Primary Electrons, Secondary Electrons, and Ions in the Discharge Chamber of an Ion Engine

Mahalingam, Sudhakar; Menart, James A.; July 2005; 25 pp.; In English; 41st Joint Propulsion Conference and Exhibit, 10-13 Jul. 2005, Tucson, AZ, USA

Contract(s)/Grant(s): NAG3-2907; WBS 22-973-80-01

Report No.(s): NASA/CR-2005-213833; E-15203; AIAA Paper 2005-4253; No Copyright; Avail: CASI; [A03](#), Hardcopy

Computational modeling of the plasma located in the discharge chamber of an ion engine is an important activity so that the development and design of the next generation of ion engines may be enhanced. In this work a computational tool called XOOPIC is used to model the primary electrons, secondary electrons, and ions inside the discharge chamber. The details of this computational tool are discussed in this paper. Preliminary results from XOOPIC are presented. The results presented include particle number density distributions for the primary electrons, the secondary electrons, and the ions. In addition the total number of a particular particle in the discharge chamber as a function of time, electric potential maps and magnetic field maps are presented. A primary electron number density plot from PRIMA is given in this paper so that the results of XOOPIC can be compared to it. PRIMA is a computer code that the present investigators have used in much of their previous work that provides results that compare well to experimental results. PRIMA only models the primary electrons in the discharge chamber. Modeling ions and secondary electrons, as well as the primary electrons, will greatly increase our ability to predict different characteristics of the plasma discharge used in an ion engine.

Author

Ion Engines; Mathematical Models; Electrons; Computer Programs; Electric Propulsion

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20050199670 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Improvement of La_{0.65}Sr_{0.3}MnO₃-gamma-YSZ Cathodes by Infiltrating NanoSm_{0.6}Sr_{0.4}CoO₃-gamma Particles

Lu, C.; Sholklapper, T.; Chen, X.; Zhang, X.; Jacobson, C. P.; January 2005; 12 pp.; In English

Report No.(s): DE2005-837418; No Copyright; Avail: Department of Energy Information Bridge

La_{0.65}Sr_{0.3}MnO₃-delta-YSZ cathodes are infiltrated with Sm_{0.6}Sr_{0.4}CoO₃-delta (SSC) at 800 C using a precipitation method. The effect of SSC infiltration has been characterized for symmetric cells and single cells at reduced temperatures. With SSC addition the cathode polarization resistance, determined from symmetric-cell measurements, significantly decreases: from approx. 19.8 to 8.5 Omega cm² at 600 C, and from 7.7 to 3.3 Omega cm² at 650 C. Consequently, the single-cell performance with 97 percent H₂+3 percent H₂O fuel is dramatically improved, which may be attributed to the superior electrocatalytic activity of SSC in the cathodes.

NTIS

Cathodes; Particle Accelerators; Yttria-Stabilized Zirconia

20050201019 Massachusetts Inst. of Tech., Cambridge, MA USA

Theoretical Analysis of Conductance of Molecular Junctions

Stone, Morely; Li, Ju; May 2005; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0735

Report No.(s): AD-A435758; No Copyright; Avail: Defense Technical Information Center (DTIC)

The underlying motivation of this project is a fresh look at the theoretical description of electron transport across molecular junctions. In contrast to the current method which is based on the formalism of non-equilibrium Green's function, we treat transport as a dynamical problem in the framework of time-dependent density functional theory (TDDFT). The advantage of our alternative approach is an explicit, more physical description of conductance which is not restricted to linear response and ground-state properties. Our goal is to formulate a benchmark problem for which the theoretical conductance can be unambiguously established, thus elucidating the mechanisms of charge flow across junction-electrode contact, as well as allowing new interpretations of conductance switching behavior that have been observed. Although the project started on May 30, 2002, actual research did not begin until 9 months later because of personnel availability, the Co-Pi moved from MIT to OSU in September 2002, the Research Assistant, a graduate student in the Department of Nuclear Science and Engineering, was not appointed on January 15, 2003, and a Postdoctoral Associate joined the project on June 1, 2003. Presently operating under a no-cost extension, the project is scheduled to end on February 16, 2006.

DTIC

Electron Transfer; Molecular Electronics; Semiconductor Junctions

20050201648 NASA Glenn Research Center, Cleveland, OH, USA, Case Western Reserve Univ., Cleveland, OH, USA

Single-Crystal Elastic Constants of Yttria (Y₂O₃) Measured to High Temperatures

Sayir, Ali; Palko, James W.; Kriven, Waltraud M.; Sinogeikin, Sergey V.; Bass, Jay D.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Yttria, or yttrium sesquioxide (Y₂O₃), has been considered for use in nuclear applications and has gained interest relatively recently for use in infrared optics. Single crystals of yttria have been grown successfully at the NASA Glenn Research Center using a laser-heated float zone technique in a fiber and rod. Such samples allow measurement of the single-crystal elastic properties, and these measurements provide useful property data for the design of components using single crystals. They also yield information as to what degree the elastic properties of yttria ceramics are a result of the intrinsic properties of the yttria crystal in comparison to characteristics that may depend on processing, such as microstructure and intergranular phases, which are common in sintered yttria. The single-crystal elastic moduli are valuable for designing such optical components. In particular, the temperature derivatives of elastic moduli allow the dimensional changes due to heating under physical constraints, as well as acoustic excitation, to be determined. The single-crystal elastic moduli of yttria were measured by Brillouin spectroscopy up to 1200 C. The room-temperature values obtained were C(sub 11) = 223.6 + 0.6 GPa, C(sub 44) = 74.6 + 0.5 GPa, and C(sub 12) = 112.4 + 1.0 GPa. The resulting bulk and (Voigt-Reuss-Hill) shear moduli were K = 149.5 + 1.0 GPa and G(sub VRH) = 66.3 + 0.8 GPa, respectively. Linear least-squares regressions to the variation of bulk and shear moduli with temperature resulted in derivatives of dK/dT = -17 + 2 MPa/C and dG(sub VRH)/dT = -8 + 2 MPa/C.

C. Elastic anisotropy was found to remain essentially constant over the temperature range studied.

Author

Yttrium Oxides; Single Crystals; High Temperature Tests; Modulus of Elasticity

20050201658 NASA Glenn Research Center, Cleveland, OH, USA

Quantum Dots Investigated for Solar Cells

Bailey, Sheila G.; Castro, Stephanie L.; Raffaele, Ryne P.; Hepp, Aloysius F.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center has been investigating the synthesis of quantum dots of CdSe and CuInS₂ for use in intermediate-bandgap solar cells. Using quantum dots in a solar cell to create an intermediate band will allow the harvesting of a much larger portion of the available solar spectrum. Theoretical studies predict a potential efficiency of 63.2 percent, which is approximately a factor of 2 better than any state-of-the-art devices available today. This technology is also applicable to thin-film devices--where it offers a potential four-fold increase in power-to-weight ratio over the state of the art. Intermediate-bandgap solar cells require that quantum dots be sandwiched in an intrinsic region between the photovoltaic solar cell's ordinary p- and n-type regions (see the preceding figure). The quantum dots form the intermediate band of discrete states that allow sub-bandgap energies to be absorbed. However, when the current is extracted, it is limited by the bandgap, not the individual photon energies. The energy states of the quantum dot can be controlled by controlling the size of the dot. Ironically, the ground-state energy levels are inversely proportional to the size of the quantum dots. We have prepared a variety of quantum dots using the typical organometallic synthesis routes pioneered by Ba Wendi et al., in the early 1990's. The most studied quantum dots prepared by this method have been of CdSe. To produce these dots, researchers inject a syringe of the desired organometallic precursors into heated triocetylphosphine oxide (TOPO) that has been vigorously stirred under an inert atmosphere (see the following figure). The solution immediately begins to change from colorless to yellow, then orange and red/brown, as the quantum dots increase in size. When the desired size is reached, the heat is removed from the flask. Quantum dots of different sizes can be identified by placing them under a 'black light' and observing the various color differences in their fluorescence (see the photograph).

Author

Cadmium Selenides; Energy Gaps (Solid State); Energy Levels; Solar Cells

20050201664 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Power Technologies Developed for the Starshine 3 Satellite

Wilt, David M.; Hepp, Aloysius F.; Raffaele, Ryne P.; Jenkins, Phillip P.; Scheiman, David A.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The need for smaller, lightweight, autonomous power systems has recently increased with the increasing focus on microsatellites and nanosatellites. The NASA Glenn Research Center has been working on the development of such systems and recently developed several power technology demonstrations in conjunction with Project Starshine. The Starshine 3 microsatellite is designed to measure the density of the Earth's upper atmosphere as a function of solar activity and is primarily a passive experiment. Therefore, it did not need electrical power to successfully complete its primary mission, although a power system for future Starshine satellites was desired that could be used to power additional instruments to enhance the data collected. This created an excellent opportunity to test new power technologies capable of supplying this future need. Several Government and commercial interests teamed up with Glenn to provide Starshine 3 with a small power system using state-of-the-art components. Starshine 3 is also the inaugural flight of a novel integrated microelectronic power supply (IMPS) developed at Glenn.

Derived from text

Autonomy; Microelectronics; Power Supplies

20050201666 NASA Glenn Research Center, Cleveland, OH, USA, National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA

Carbon Nanotube Anodes Being Evaluated for Lithium Ion Batteries

VanderWal, Randall L.; Raffaele, Ryne P.; Gennett, Tom; Hepp, Aloysius F.; Research and Technology 2000; March 2001; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The NASA Glenn Research Center is evaluating the use of carbon nanotubes as anode materials for thin-film lithium-ion (Li) batteries. The motivation for this work lies in the fact that, in contrast to carbon black, directed structured nanotubes and nanofibers offer a superior intercalation media for Li-ion batteries. Carbon lamellas in carbon blacks are circumferentially

oriented and block much of the particle interior, rendering much of the matrix useless as intercalation material. Nanofibers, on the other hand, can be grown so as to provide 100-percent accessibility of the entire carbon structure to intercalation. These tubes can be visualized as 'rolled-up' sheets of carbon hexagons (see the following figure). One tube is approximately 1/10,000th the diameter of a human hair. In addition, the high accessibility of the structure confers a high mobility to ion-exchange processes, a fundamental for the batteries to respond dynamically because of intercalation.

Derived from text

Carbon; Nanotubes; Anodes; Electric Batteries

20050201667 NASA Glenn Research Center, Cleveland, OH, USA

Atmospheric-Pressure-Spray, Chemical- Vapor-Deposited Thin-Film Materials Being Developed for High Power-to-Weight-Ratio Space Photovoltaic Applications

Hepp, Aloysius F.; Harris, Jerry D.; Raffaele, Ryne P.; Banger, Kulbinder K.; Smith, Mark A.; Cowen, Jonathan E.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The key to achieving high specific power (watts per kilogram) space photovoltaic arrays is the development of high-efficiency thin-film solar cells that are fabricated on lightweight, space-qualified substrates such as Kapton (DuPont) or another polymer film. Cell efficiencies of 20 percent air mass zero (AM0) are required. One of the major obstacles to developing lightweight, flexible, thin-film solar cells is the unavailability of lightweight substrate or superstrate materials that are compatible with current deposition techniques. There are two solutions for working around this problem: (1) develop new substrate or superstrate materials that are compatible with current deposition techniques, or (2) develop new deposition techniques that are compatible with existing materials. The NASA Glenn Research Center has been focusing on the latter approach and has been developing a deposition technique for depositing thin-film absorbers at temperatures below 400 C.

Derived from text

Atmospheric Pressure; Sprayers; Vapor Deposition; Thin Films; Photovoltaic Cells

20050201668 NASA Glenn Research Center, Cleveland, OH, USA

Silicon Carbide Solar Cells Investigated

Bailey, Sheila G.; Raffaele, Ryne P.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

The semiconductor silicon carbide (SiC) has long been known for its outstanding resistance to harsh environments (e.g., thermal stability, radiation resistance, and dielectric strength). However, the ability to produce device-quality material is severely limited by the inherent crystalline defects associated with this material and their associated electronic effects. Much progress has been made recently in the understanding and control of these defects and in the improved processing of this material. Because of this work, it may be possible to produce SiC-based solar cells for environments with high temperatures, light intensities, and radiation, such as those experienced by solar probes. Electronics and sensors based on SiC can operate in hostile environments where conventional silicon-based electronics (limited to 350 C) cannot function. Development of this material will enable large performance enhancements and size reductions for a wide variety of systems--such as high-frequency devices, high-power devices, microwave switching devices, and high-temperature electronics. These applications would supply more energy-efficient public electric power distribution and electric vehicles, more powerful microwave electronics for radar and communications, and better sensors and controls for cleaner-burning, more fuel-efficient jet aircraft and automobile engines. The 6H-SiC polytype is a promising wide-bandgap ($E_g = 3.0$ eV) semiconductor for photovoltaic applications in harsh solar environments that involve high-temperature and high-radiation conditions. The advantages of this material for this application lie in its extremely large breakdown field strength, high thermal conductivity, good electron saturation drift velocity, and stable electrical performance at temperatures as high as 600 C. This behavior makes it an attractive photovoltaic solar cell material for devices that can operate within three solar radii of the Sun.

Author

Silicon Carbides; Solar Cells; Electric Power Transmission; Electrical Properties; Performance Tests

20050201900 NASA Glenn Research Center, Cleveland, OH, USA, Ohio Aerospace Inst., OH, USA

Photovoltaic Engineering Testbed Designed for Calibrating Photovoltaic Devices in Space

Landis, Geoffrey A.; Research and Technology 2001; March 2002; 4 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

Accurate prediction of the performance of solar arrays in space requires that the cells be tested in comparison with a space-flown standard. Recognizing that improvements in future solar cell technology will require an ever-increasing fidelity

of standards, the Photovoltaics and Space Environment Branch at the NASA Glenn Research Center, in collaboration with the Ohio Aerospace Institute, designed a prototype facility to allow routine calibration, measurement, and qualification of solar cells on the International Space Station, and then the return of the cells to Earth for laboratory use. For solar cell testing, the Photovoltaic Engineering Testbed (PET) site provides a true air-mass-zero (AM0) solar spectrum. This allows solar cells to be accurately calibrated using the full spectrum of the Sun.

Derived from text

Photovoltaic Conversion; Performance Prediction; Solar Arrays

20050203658 NASA Glenn Research Center, Cleveland, OH, USA

LEO Flight Testing of GaAs on Si Solar Cells Aboard MISSE5

Wilt, David M.; Clark, Eric B.; Ringel, Steven A.; Andre, Carrie L.; Smith, Mark A.; Scheiman, David A.; Jenkins, Phillip P.; Maurer, William F.; Fitzgerald, Eugene A.; Walters, R. J., et al.; [2004]; 1 pp.; In English; 19th European Photovoltaic Solar Energy Conference and Exhibition, 7-11 Jun. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

Previous research efforts have demonstrated small area (0.04 cm) GaAs on Si (GaAs/Si) solar cells with AM0 efficiencies in excess of 17%. These results were achieved on Si substrates coated with a step graded buffer of Si(x),Ge(1-x) alloys graded to 100% Ge. Recently, a 100-fold increase in device area was accomplished for these devices in preparation for on-orbit testing of this technology aboard Materials International Space Station Experiment number 5 (MISSE5). The GaAs/Si MISSE5 experiment contains five (5) GaAs/Si test devices with areas of 1cm(exp 2) and 4cm(exp 4) as well as two (2) GaAs on GaAs control devices. Electrical performance data, measured on-orbit for three (3) of the test devices and one (1) of the control devices, will be telemetered to ground stations daily. After approximately one year on orbit, the MISSE5 payload will be returned to Earth for post flight evaluation. This paper will discuss the development of the GaAs/Si devices for the MISSE5 flight experiment and will present recent ground and on-orbit performance data.

Author

Flight Tests; Gallium Arsenides; Low Earth Orbits; Solar Cells; Spaceborne Experiments; Silicon

20050203661 NASA Glenn Research Center, Cleveland, OH, USA

Buffer Layer Effects on Tandem InGaAs TPV Devices

Wilt, David M.; Wehrer, Rebecca J.; Maurer, William F.; [2004]; 1 pp.; In English; 6th Conference on Thermophotovoltaic Generation of Electricity, 14-16 Jun. 2004, Freilburg, Germany; No Copyright; Avail: CASI; [A01](#), Hardcopy

Single junction indium gallium arsenide (InGaAs) based TPV devices have demonstrated efficiencies in excess of 20% at radiator temperatures of 1058 C. Modeling suggests that efficiency improvements in single bandgap devices should continue although they will eventually plateau. One approach for extending efficiencies beyond the single bandgap limit is to follow the technique taken in the solar cell field, namely tandem TPV cells. Tandem photovoltaic devices are traditionally composed of cells of decreasing bandgap, connected electrically and optically in series. The incident light impinges upon the highest bandgap first. This device acts as a sieve, absorbing the high-energy photons, while allowing the remainder to pass through to the underlying cell(s), and so on. Tandem devices reduce the energy lost to overexcitation as well as reducing the current density (Jsc). Reduced Jsc results in lower resistive losses and enables the use of thinner and lower doped lateral current conducting layers as well as a higher pitch grid design. Fabricating TPV tandem devices utilizing InGaAs for all of the component cells in a two cell tandem necessitates the inclusion of a buffer layer in-between the high bandgap device (In_{0.53}Ga_{0.47}As - 0.74eV) and the low bandgap device (In_{0.66}Ga_{0.34}As - 0.63eV) to accommodate the approximately 1% lattice strain generated due to the change in InGaAs composition. To incorporate only a single buffer layer structure, we have investigated the use of the indium phosphide (InP) substrate as a superstrate. Thus the high-bandgap, lattice- matched device is deposited first, followed by the buffer structure and the low-bandgap cell. The near perfect transparency of the high bandgap (1.35eV) iron-doped InP permits the device to be oriented such that the light enters through the substrate. In this paper we examine the impact of the buffer layer on the underlying lattice-matched InGaAs device. 0.74eV InGaAs devices were produced in a variety of configurations both with and without buffer layers. All structures were characterized by reciprocal space x-ray diffraction to determine epilayer composition and residual strain. Electrical characterization of the devices was performed to examine the effect of the buffer on the device performance. The effect of the buffer structure depends upon where it is positioned. When near the emitter region, a 2.6x increase in dark current was measured, whereas no change in dark current was observed when it was near the base region.

Author

Fabrication; Indium Gallium Arsenides; Buffers (Chemistry); Thermophotovoltaic Conversion

20050203753 NASA Glenn Research Center, Cleveland, OH, USA

16th Space Photovoltaic Research and Technology Conference

Bailey, Sheila, Editor; May 2005; 270 pp.; In English; 16th Space Photovoltaic Research and Technology Conference, 31 Aug. - 2 Sep. 1999, Brook Park, OH, USA; See also 20050203754 - 20050203791; Original contains black and white illustrations

Contract(s)/Grant(s): WU 755-A4-02

Report No.(s): NASA/CP-2001-210747/REV1; E-12676-1/REV1; No Copyright; Avail: CASI; [A12](#), Hardcopy

The purpose of the SPRAT conference is to bring members of the space solar cell community together in a relatively informal conference setting to discuss the recent developments in solar cell technology and to discuss the future directions of the field. The conference is sponsored by the Photovoltaic and Space Environmental Effects Branch at the NASA Glenn Research Center.

Author

Aerospace Environments; Photovoltaic Effect; Solar Cells

20050203754 NASA Glenn Research Center, Cleveland, OH, USA

Report of the Workshop on Next-Generation Space PV: Thin Films

Raffaella, R. P.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 253-255; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

A workshop on the future use of thin-film photovoltaic devices in space power was convened at the 16th Space Photovoltaic Research and Technology Conference held at the NASA Glenn Research Center in Cleveland, OH. This workshop began by addressing: 1) What are the leading impediments or technological challenges to be overcome with regard to the use of thin-film PV in space? 2) What is the status of organic based cells? Will they have a role in space PV, if so when? and 3) What about an integrated PV/Li battery array-up and down sides? A discussion on these three questions pertaining to future use of thin film devices for space power systems is presented

Derived from text

Conferences; Spacecraft Power Supplies; Thin Films; Photovoltaic Cells

20050203756 NASA Glenn Research Center, Cleveland, OH, USA

Novel Passivating/Antireflective Coatings for Space Solar Cells

Faur, Mircea; Faur, Maria; Bailey, S. G.; Flood, D. J.; Faur, H. M.; Mateescu, C. G.; Alterovitz, S. A.; Scheiman, D.; Jenkins, P. P.; Brinker, D. J., et al.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 220-229; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

We are developing a novel process to grow passivating/antireflective (AR) coatings for terrestrial and space solar cells. Our approach involves a Room Temperature Wet Chemical Growth (RTWCG) process, which was pioneered, and is under development at SPECMAT, Inc., under a Reimbursable Space Act Agreement with NASA Glenn Research Center. The RTWCG passivating/AR coatings with graded index of refraction are applied in one easy step on finished (bare) cells. The RTWCG coatings grown on planar, textured and porous Si, as well as on poly-Si, CuInSe₂, and III-V substrates, show excellent uniformity irrespective of surface topography, crystal orientation, size and shape. In this paper we present some preliminary results of the RTWCG coatings on Si and III-V substrates that show very good potential for use as a passivation/AR coating for space solar cell applications. Compared to coatings grown using conventional techniques, the RTWCG coatings have the potential to reduce reflection losses and improve current collection near the illuminated surface of space solar cells, while reducing the fabrication costs.

Author

Solar Cells; Thin Films; Antireflection Coatings

20050203761 Essential Research, Inc., Cleveland, OH, USA

High-Efficiency Multi-Junction Space Solar Development Utilizing Lattice Grading

Stan, Mark A.; Weizer, Victor G.; Pal, AnnaMaria; Garverick, Linda M.; Khan, Osman; Sinharoy, Samar; Hoffman, Richard W., Jr.; Jenkins, Phillip P.; Scheiman, David A.; Fatemi, Navid S.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 122-128; In English; See also 20050203753

Contract(s)/Grant(s): NAS3-98026; No Copyright; Avail: CASI; [A02](#), Hardcopy

Progress towards achieving a high one-sun air mass 0 (AM0) efficiency in a monolithic dual junction solar cell comprised of a 1.62 eV InGaP top cell and a 1.1 eV InGaAs bottom cell grown on buffered GaAs is reported. The performance of

stand-alone 1.62 eV InGaP and 1.1 eV InGaAs cells is compared to that of the dual junction cell. Projected AM0 efficiencies of 15.7% and 16.5% are expected for the 1.62 eV InGaP and 1.1 eV InGaAs cells grown on buffered GaAs. The dual junction cell has a projected one-sun AM0 conversion efficiency of 17%. The projected efficiencies are based upon the application of an optimized anti-reflective coating (ARC) to the as-grown cells. Quantum efficiency (QE) data obtained from the dual junction cell indicate that is is bottom cell current limited with the top cell generating 50% more current than the bottom cell. A comparison of the QE data for the stand-alone 1.1 eV InGaAs cell to that of the 1.1 eV InGaAs bottom cell in the tandem configuration indicates a degradation of the bottom cell conversion efficiency in the tandem configuration. The origin of this performance degradation is at present unknown. If the present limitation can be overcome, then a one-sun AM0 efficiency of 26% is achievable with the 1.62 eV/1.1 eV dual junction cell grown lattice-mismatched to GaAs.

Author

Solar Cells; Indium Gallium Arsenides; Gallium Arsenides; Indium Phosphides; Crystal Lattices

20050203762 Houston Univ., TX, USA

High Growth Rate Metal-Organic Molecular Beam Epitaxy for the Fabrication of GaAs Space Solar Cells

Freundlich, A.; Newman, F.; Monier, C.; Street, S.; Dargan, P.; Levy, M.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 117-121; In English; See also 20050203753; Original contains black and white illustrations
Contract(s)/Grant(s): NCC8-127; No Copyright; Avail: CASI; [A01](#), Hardcopy

In this work it is shown that high quality GaAs photovoltaic devices can be produced by Molecular Beam Epitaxy (MBE) with growth rates comparable to metal-organic chemical vapor deposition (MOCVD) through the substitution of group III solid sources by metal-organic compounds. The influence the III/V flux-ratio and growth temperatures in maintaining a two dimensional layer by layer growth mode and achieving high growth rates with low residual background impurities is investigated. Finally subsequent to the study of the optimization of n- and p doping of such high growth rate epilayers, results from a preliminary attempt in the fabrication of GaAs photovoltaic devices such as tunnel diodes and solar cells using the proposed high growth rate approach are reported.

Derived from text

Molecular Beam Epitaxy; Organometallic Compounds; Gallium Arsenides; Solar Cells

20050203764 Toyota Motor Co., Nagoya, Japan

Analysis of the Role of Deep Levels in Anomalous Degradation of Si Space Solar Cells

Khan, Aurangzeb; Yamaguchi, Masafumi; Taylor, Stephen J.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 30; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

Over the past 30 years, many works have been done to investigate the origin of the radiation-induced defects in Si and space cells. However, anomalous degradation of Si space cells under high fluence irradiation stimulates further studies on radiation-induced defects that play the dominant role in type conversion (carrier removal) in Si as well as the origin of some major defects. In this study, deep level transient spectroscopy (DLTS) analysis of defects in p-type Si has been carried out for n(+)-p-p(+) Si space cells irradiated with heavy fluence of 1-MeV electrons and 10-MeV protons, in order to clarify mechanism on anomalous degradation of Si cells and origins of radiation-induced defects in Si. We are able to correlate degradation of the minority carrier diffusion length L determined by solar cell properties and introduction of deep levels determined by DLTS. The $E_{\text{sub V}} + 0.36$ eV majority carrier trap center correlates with degradation of minority-carrier diffusion length in p-Si base layer of the Si cells and thus is thought to act as a recombination center. Some of the interesting new information provided by our work is that type conversion of the base layer, is mainly due to a large concentration of a new electron trap ($E_{\text{sub c}} - 0.71$ eV) in type converted Si and a deep donor center ($E_{\text{sub c}} - 0.2$ eV) in p-Si. The radiation-induced traps, which play an important role regarding the carrier removal and conduction type conversion of the base region, are thought to be principally deep-level donors, which are positively charged before electron capture, leading to the compensation of the base layer of the cells. The irradiation not only changes the structure of the device (from p to n-type) but also makes the complex defect structure as compared to simple defect structure in low dose samples. Additional information is included in the original extended abstract.

Author (revised)

Anomalies; Silicon; Solar Cells; Degradation; Defects; Radiation Damage; Proton Irradiation; Electron Irradiation

20050203766 Naval Research Lab., Washington, DC, USA

Radiation Hard Multi-Quantum Well InP/InAsP Solar Cells for Space Applications

Walters, R. J.; Summers, G. P.; Messenger, S. R.; Freundlich, A.; Monier, C.; Newman, F.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 31-34; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The U.S. Naval Research Laboratory (NRL) and the University of Houston (UH) are conducting a collaborative research effort studying InP/InAsP multi-quantum well (MQW) solar cells. The goal of this research is to demonstrate a high-efficiency InP solar cell, grown heteroepitaxially on a Si substrate. This technology is of interest because it is expected to show the extreme radiation resistance of InP combined with the durability and cost effectiveness of Si. However, it is well known that a high-quality InP/Si device is difficult to realize due to the lattice mismatch between InP and Si. For this reason, MQW layers have been incorporated into the InP/Si cell. The MQW layers increase the spectral range of the cell response thereby increasing the photocurrent and allowing for a thinner cell. The MQW cell should, therefore, be able to operate efficiently despite the reduced minority carrier diffusion length of an InP/Si cell. Furthermore, a MQW cell should provide advantages in a multi-junction cell (i.e. InP/InGaAs/Si) in terms of overall efficiency and end-of-life current matching. While the MQW layers offer the potential for increased photocurrent, they also can lead to an increase in dark current and hence reduced operating voltage. The technical challenge is, then, to balance these effects to achieve a cell with improved efficiency. Furthermore, the radiation response mechanisms of the MQW cell must be understood in order to simultaneously optimize the beginning-of-life (BOL) and end-of-life (EOL) device performance. In this paper, the latest results of this research are presented. MQW cells with varied structures have been fabricated and radiation tested to determine the effect of cell structure on the BOL and EOL performance and to determine the optimum structure for a MQW InP/Si cell for use in space.

Author

Radiation Hardening; Quantum Wells; Solar Cells; Indium Phosphides; Epitaxy; Silicon

20050203771 Florida Solar Energy Center, FL, USA

Cu(In,Ga)S₂, Thin-Film Solar Cells Prepared by H₂S Sulfurization of CuGa-In Precursor

Dhere, Neelkanth G.; Kulkarni, Shashank R.; Chavan, Sanjay S.; Ghongadi, Shantinath R.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 164-176; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

Thin-film CuInS₂ solar cell is the leading candidate for space power because of bandgap near the optimum value for AM0 solar radiation outside the earth's atmosphere, excellent radiation hardness, and freedom from intrinsic degradation mechanisms unlike a-Si:H cells. Ultra-lightweight thin-film solar cells deposited on flexible polyimide plastic substrates such as Kapton(trademark), Upilex(trademark), and Apical(trademark) have a potential for achieving specific power of 1000 W/kg, while the state-of-art specific power of the present day solar cells is 66 W/kg. This paper describes the preparation of Cu-rich CuIn(sub 1-x)Ga(sub x)S(sub 2) (CIGS₂) thin films and solar cells by a process of sulfurization of CuGa-In precursor similar to that being used for preparation of large-compact-grain CuIn(sub 1-x)Ga(sub x)Se₂ thin films and efficient solar cells at FSEC PV Materials Lab.

Author (revised)

Solar Cells; Thin Films; Hydrogen Sulfide; Copper Sulfides

20050203776 NASA Glenn Research Center, Cleveland, OH, USA

Electrical Characterization of Defects in SiC Schottky Barriers

Schnabel, C. M.; Tabib-Azar, M.; Raffaele, R. P.; Su, H. B.; Dudley, M.; Neudeck, P. G.; Bailey, S.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 183-188; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

We have been investigating the effect of screw dislocation and other structural defects on the electrical properties of SiC. SiC is a wide-bandgap semiconductor that is currently received much attention due to its favorable high temperature behavior and high electric field breakdown strength. Unfortunately, the current state-of-the-art crystal growth and device processing methods produce material with high defect densities, resulting in a limited commercial viability

Author (revised)

Silicon Carbides; Defects; High Strength; Screw Dislocations; Semiconductors (Materials); Electrical Properties

20050203780 NASA Glenn Research Center, Cleveland, OH, USA

30% Efficient InGaP/GaAs/GaSb Cell-Interconnected-Circuits For Line-Focus Concentrator Arrays

Fraas, Lewis; Avery, James; Iles, Peter; Chu, Charlie; Piszczor, Mike; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 110-116; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

In 1989, Fraas and Avery demonstrated a world-record 31% efficient AM0 GaAs/GaSb tandem solar cell. This record efficiency still holds today. However, the GaAs/GaSb mechanical-stacked cell was designed to work with concentrated

sunlight and at that time, the space community had no experience with concentrated sunlight solar arrays.

Derived from text

Gallium Antimonides; Gallium Arsenides; Gallium Phosphides; Indium Phosphides

20050203782 NASA Glenn Research Center, Cleveland, OH, USA

Chemically Deposited Thin-Film Solar Cell Materials

Raffaella, R.; Junek, W.; Gorse, J.; Thompson, T.; Harris, J.; Hehemann, D.; Hepp, A.; Rybicki, G.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 158-163; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

We have been working on the development of thin film photovoltaic solar cell materials that can be produced entirely by wet chemical methods on low-cost flexible substrates. P-type copper indium diselenide (CIS) absorber layers have been deposited via electrochemical deposition. Similar techniques have also allowed us to incorporate both Ga and S into the CIS structure, in order to increase its optical bandgap. The ability to deposit similar absorber layers with a variety of bandgaps is essential to our efforts to develop a multi-junction thin-film solar cell. Chemical bath deposition methods were used to deposit a cadmium sulfide (CdS) buffer layers on our CIS-based absorber layers. Window contacts were made to these CdS/CIS junctions by the electrodeposition of zinc oxide (ZnO). Structural and elemental determinations of the individual ZnO, CdS and CIS-based films via transmission spectroscopy, x-ray diffraction, x-ray photoelectron spectroscopy and energy dispersive spectroscopy will be presented. The electrical characterization of the resulting devices will be discussed.

Author

Photovoltaic Cells; Solar Cells; Thin Films; Electrodeposition

20050203786 Wayne State Univ., Detroit, MI, USA

Investigations To Characterize Multi-Junction Solar Cells In The Stratosphere Using Low-Cost Balloon And Communication Technologies

Bowe, Glenroy A.; Wang, Qianghua; Woodyard, James R.; Johnston, Richard R.; Brown, William J.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 189-194; In English; See also 20050203753

Contract(s)/Grant(s): NAG3-2180; No Copyright; Avail: CASI; [A02](#), Hardcopy

The use of current balloon, control and communication technologies to test multi-junction solar cell in the stratosphere to achieve near AMO conditions have been investigated. The design criteria for the technologies are that they be reliable, low cost and readily available. Progress is reported on a program to design, launch, fly and retrieve payloads dedicated to testing multi-junction solar cells.

Author (revised)

Solar Cells; Stratosphere; Design Analysis

20050203787 Wayne State Univ., Detroit, MI, USA

Investigation of the Carbon Arc Source as an AM0 Solar Simulator for Use in Characterizing Multi-Junction Solar Cells

Xu, Jianzeng; Woodward, James R.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 177-182; In English; See also 20050203753; No Copyright; Avail: CASI; [A02](#), Hardcopy

The operation of multi-junction solar cells used for production of space power is critically dependent on the spectral irradiance of the illuminating light source. Unlike single-junction cells where the spectral irradiance of the simulator and computational techniques may be used to optimized cell designs, optimization of multi-junction solar cell designs requires a solar simulator with a spectral irradiance that closely matches AM0.

Author (revised)

Carbon Arcs; Solar Simulators; Solar Cells

20050203801 NASA Glenn Research Center, Cleveland, OH, USA

High Electron Mobility Transistor Structures on Sapphire Substrates Using CMOS Compatible Processing Techniques

Mueller, Carl; Alterovitz, Samuel; Croke, Edward; Ponchak, George; February 25, 2004; 2 pp.; In English; 2004 Electronic Materials Conference, 21-24 Jun. 2004, Notre Dame, IN, USA; No Copyright; Avail: CASI; [A01](#), Hardcopy

System-on-a-chip (SOC) processes are under intense development for high-speed, high frequency transceiver circuitry. As frequencies, data rates, and circuit complexity increases, the need for substrates that enable high-speed analog operation, low-power digital circuitry, and excellent isolation between devices becomes increasingly critical. SiGe/Si modulation doped

field effect transistors (MODFETs) with high carrier mobilities are currently under development to meet the active RF device needs. However, as the substrate normally used is Si, the low-to-moderate substrate resistivity causes large losses in the passive elements required for a complete high frequency circuit. These losses are projected to become increasingly troublesome as device frequencies progress to the Ku-band (12 - 18 GHz) and beyond. Sapphire is an excellent substrate for high frequency SOC designs because it supports excellent both active and passive RF device performance, as well as low-power digital operations. We are developing high electron mobility SiGe/Si transistor structures on r-plane sapphire, using either in-situ grown n-MODFET structures or ion-implanted high electron mobility transistor (HEMT) structures. Advantages of the MODFET structures include high electron mobilities at all temperatures (relative to ion-implanted HEMT structures), with mobility continuously improving to cryogenic temperatures. We have measured electron mobilities over 1,200 and 13,000 sq cm/V-sec at room temperature and 0.25 K, respectively in MODFET structures. The electron carrier densities were 1.6 and 1.33×10^{12} /sq cm at room and liquid helium temperature, respectively, denoting excellent carrier confinement. Using this technique, we have observed electron mobilities as high as 900 sq cm/V-sec at room temperature at a carrier density of 1.3×10^{12} /sq cm. The temperature dependence of mobility for both the MODFET and HEMT structures provides insights into the mechanisms that allow for enhanced electron mobility as well as the processes that limit mobility, and will be presented.

Derived from text

CMOS; High Electron Mobility Transistors; Sapphire; Substrates; Systems-on-a-Chip **77** *Physics of Elementary Particles and Fields*

80

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20050199749 NASA Glenn Research Center, Cleveland, OH, USA, Bristol Univ., UK

NASA Participated in the Japan 2001 Science, Creativity and the Young Mind Workshop

Kolecki, Joseph C.; Petersen, Ruth A.; Research and Technology 2001; March 2002; 3 pp.; In English; No Copyright; Avail: CASI; **A01**, Hardcopy

During the week of July 23, 2001, a workshop called the Japan 2001 Science, Creativity and the Young Mind took place at Bristol University in Bristol, England. Coordinated by the Clifton Scientific Trust, it brought together 60 British and Japanese students and provided them with a forum for learning and interacting. All the students were chosen from geographical areas of social deprivation, where university education is not seen as a natural progression for students. One of the aims of the workshop was to give the combined group a new view of themselves as potential scientists and an ambition to succeed at the highest level. Members of the Glenn Research Center's Learning Technologies Project participated with six of the students and their team leaders as a Space Science Team. Four interactive videoconferencing sessions were held between the NASA Glenn Research Center and Bristol University on four consecutive days. During the sessions, students raised questions concerning various theories about the probable formation of volcanoes on Mars. Of specific interest was if the great Tharsis volcanoes might be the result of an ancient collision of planetary proportions, or if plate tectonic movement, evidence for which was recently discovered by NASA's Mars Global Surveyor Spacecraft, might account for them.

Derived from text

Educational Resources; Students; Conferences; United Kingdom; Japan; Video Conferencing; NASA Programs

20050201773 Belgrade Univ., Yugoslavia

Wisdom of Education for Globalization

Milutinovic, Veljko; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 3-5; In English; See also 20050201770; Original contains black and white illustrations; Copyright; Avail: CASI; **A01**, Hardcopy

This paper presents possible success strategies and tactics in the era of globalization.

CASI

Education; Intelligence; Knowledge

20050203816 Charles Darwin Univ., Darwin, Australia

Robert Wilhelm Eberhard Bunsen (1811-1899): A Chemist Of Distinction

Palmer, William; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 10 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The biographies of scientists can act as catalysts to achieve for each new generation of scientists and so the retelling of an old story using a variety of sources reinforced by today's technology can be worthwhile. The story of Robert Wilhelm Eberhard Bunsen deserves some detailed attention because, in his research and in his relations with other scientists, he typified many of the finer ideals attributed to science. This study includes many of the anecdotes about him, some humorous and some stereotypical of scientists; these are intended to show the humanity of science.

Derived from text

Biography; Physical Sciences; Chemical Elements

20050203898 Curtin Univ. of Technology, Perth, Australia

Combining Old Teaching Methods and New Technology to Create Happier Students

D'Arcu-Warmington, Anne; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 10 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The tacit dimension of teaching and learning even with all the advances in technology still remains important today. Emotions and environment whilst learning mathematics become memories that are foundations to mathematical comprehension. New advances with online assistance and assessment serve to enhance teaching strategies not necessarily replace them. The creation of friendly face for both lecturer and computer means students can feel free to study further or may just leave with good vibes about mathematics hence reducing the mathematics negativity cycle. The student may now see the mark of 5/10 as halfway to success rather than halfway to failure.

Author

Education; Failure; Students

20050203911 Open Univ., Milton Keynes, UK

Net-Conferencing as an e-Learning Tool to Improve Retention Rates on a Mathematics Course Taught by Distance Learning

Dyke, John G.; Jenkins, Lynne D.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Communicating mathematically by telephone or by correspondence tuition can be extremely difficult. In addition, attendance at face-to-face tutorials can be difficult for many students e.g. for those who are geographically isolated or for students with disabilities. The net-conferencing project discussed in this paper was undertaken to investigate how new technologies, in particular a graphics pad used in conjunction with the Net-Meeting conferencing system, could be used to improve communication between tutor and student on a distance learning mathematics degree course and to investigate the hypothesis that this improved communication would lead to higher average marks and improved retention rates.

Author

Communicating; Students; Telephones; Disabilities; Education; Technology Utilization; Teleconferencing

20050203926 Barry Univ., Miami Shores, FL, USA

Case Study: Commonalities in the Re-acculturation Process to the University Environment for Adult Learners and Students with Diverse Backgrounds

Deeb, Khaled Kevin; Cronin, Adriana; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 9 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents the two-fold challenges that educators should be aware of and the practical techniques that can be implemented and incorporated into teaching and curriculum design in order to assist their adult students in the successful

integration into the classroom environment. Through innovative data-gathering and sharing technology, a collaborative effort that would improve communication and build a virtual bridge among peers and between the educator and student can be integrated within the curriculum. Through the introduction of this methodology, the educator is also better able to recognize and reward participation of ideas and knowledge that are captured from each student's unique educational, cultural, economic and professional background.

Author

Economics; Education; Students

20050203928 Savannah State Univ., Savannah, GA, USA

Visual Literacy Merging Global Cultures

Blood, Peggy; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the increasingly digitized world of higher education it is time we rethink the traditional education delivery system. Spurring of technology has contributed to pedagogical delivery, not its structure advancement. Academia moves slowly in adjusting to change. How can technology structure and deliver really great learning experiences in the humanities? Teaching in the humanities should be a global collaboration, i.e., a professor who has lived, experienced and been educated in Russia would be the sole teacher of Russian culture. Thus, students will objectively compare and contrast Russian philosophical thoughts with those of Asians, Americans, and etc professors. The bias is natural and is not skewed to one side.

Author

Education; Instructors; Students; Reading

20050203934 Chicago Education Alliance, Chicago, IL, USA

Reinventing Education 3(RE3): The Chicago Collaborative - A Catalyst for Rethinking Teacher Education

Holloway, Bernice E.; Rosch, Terylann; Pedersen, Cynthia; Schiener, John; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 17 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation highlights the Chicago Reinventing Education 3 (RE3): Teacher Education grant project--a collaborative partnership between IBM Corporation, the Chicago Education Alliance and its affiliated partners (the Chicago Teacher Union's Quest Center, DePaul, Illinois State, Northeastern Illinois and Roosevelt University, and Chicago Public Schools). Highlights include (1) how partner institutions utilize innovative applications of the IBM Learning Village (LV) web-based technology as a common instrument for communication, mentoring, and support for teacher educators; (2) how the RE3 project serves as a catalyst to explore and develop innovative ways to use IBM new web-based tools to creatively address specific needs of each partner, and achieve results that can be replicated.

Author

Education; Instructors; IBM Computers; Illinois

81

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20050199511 NASA Langley Research Center, Hampton, VA, USA

Virtual Laboratory Enabling Collaborative Research in Applied Vehicle Technologies

Lamar, John E.; Cronin, Catherine K.; Scott, Laura E.; [2005]; 18 pp.; In English; RTO/AVT-123 Symposium on Flow Induced Unsteady Loads and the Impact on Military Applications, 25-29 Apr. 2005, Budapest, Hungary; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-090-50-70

Report No.(s): RTO-MP-AVT-123; No Copyright; Avail: CASI; [A03](#), Hardcopy

The virtual laboratory is a new technology, based on the internet, that has had wide usage in a variety of technical fields because of its inherent ability to allow many users to participate simultaneously in instruction (education) or in the collaborative study of a common problem (real-world application). The leadership in the Applied Vehicle Technology panel

has encouraged the utilization of this technology in its task groups for some time and its parent organization, the Research and Technology Agency, has done the same for its own administrative use. This paper outlines the application of the virtual laboratory to those fields important to applied vehicle technologies, gives the status of the effort, and identifies the benefit it can have on collaborative research. The latter is done, in part, through a specific example, i.e. the experience of one task group.

Author

Research Vehicles; Leadership; Management Systems

20050201744 Massachusetts Inst. of Tech., Westford, MA, USA

IVS Technology Coordinator Report

Whitney, Alan; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 38-41; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The efforts of the Technology Coordinator in 2004 were primarily in the following areas: 1. Continued work on IVS Working Group 3 'VLBI2010' study. 2. Continued development and deployment of e-VLBI. 3. Support of the 3d annual e-VLBI Workshop held in Japan. We will describe each of these briefly.

Author

Very Long Base Interferometry; Manufacturing

20050201774 Hakuoh Univ., Tochigi, Japan

Adaptive Collaboration: The Road Map Leading Telework to a More Advanced and Professional Working Format

Hori, Mayumi; Ohashi, Masakazu; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 36-42; In English; See also 20050201770; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

In this chapter, we would like to discuss the Adaptive Collaborative Tele Work as medium which connects individual to individuals, individual to organization, individual to community, individual to society, and individual to the world as large without the restriction of time or location. Information and Communication Technology (ICT) offers new ways to provide more flexibility to the working format. Especially the new method that integrates a number of different systems and applications into one system to enable the Adaptive Collaborative Telework has been generating much attention as it may meet the diverse and growing demands in the future of the Ubiquitous Society. In other words, in our Ubiquitous Society with advanced ICT infrastructure, tacit knowledge, the most difficult yet valuable type of knowledge to be transmitted which is gained through personal experiences and stored within individuals, has better chances to be transferred and stored on the network. Therefore, it is required to build a platform to make tacit knowledge more accessible and sharable in the society. The Next Generation Collaborative Studies Platform in Tokyo have been built since April 2003. Not only the experiment enabled people to share data through telecommunication, it also demonstrated that utilizing the knowledge management systems in conjunction with the WDM facilitates an enhanced communication structure. In essence, the union of the two systems creates a real-time collaborative research environment by allowing users to share the processes and results of researches between the institutions regardless of their location. The purpose of this paper is to illustrate the road map to lead telework to a more advanced and professional working format by applying the Adaptive Collaboration. Also we would like to examine telework's effectiveness for human resources and how it would efficiently facilitate the Adaptive Collaboration environment, which may characteristically represent the working format for the 21st century.

Author

Information Systems; Adaptive Control; Telecommunication

20050202016 La Salle Univ., Philadelphia, PA, USA

D-Side: A Facility and Workforce Planning Group Multi-criteria Decision Support System for Johnson Space Center

Tavana, Madjid; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 21-1 - 21-20; In English; See also 20050202011

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

'To understand and protect our home planet, to explore the universe and search for life, and to inspire the next generation of explorers' is NASA's mission. The Systems Management Office at Johnson Space Center (JSC) is searching for methods to effectively manage the Center's resources to meet NASA's mission. D-Side is a group multi-criteria decision support system (GMDSS) developed to support facility decisions at JSC. D-Side uses a series of sequential and structured processes to plot facilities in a three-dimensional (3-D) graph on the basis of each facility alignment with NASA's mission and goals, the extent to which other facilities are dependent on the facility, and the dollar value of capital investments that have been

postponed at the facility relative to the facility replacement value. A similarity factor rank orders facilities based on their Euclidean distance from Ideal and Nadir points. These similarity factors are then used to allocate capital improvement resources across facilities. We also present a parallel model that can be used to support decisions concerning allocation of human resources investments across workforce units. Finally, we present results from a pilot study where 12 experienced facility managers from NASA used D-Side and the organization's current approach to rank order and allocate funds for capital improvement across 20 facilities. Users evaluated D-Side favorably in terms of ease of use, the quality of the decision-making process, decision quality, and overall value-added. Their evaluations of D-Side were significantly more favorable than their evaluations of the current approach. Keywords: NASA, Multi-Criteria Decision Making, Decision Support System, AHP, Euclidean Distance, 3-D Modeling, Facility Planning, Workforce Planning.

Author

Human Resources; Systems Management; Three Dimensional Models

20050203716 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Swift Project Contamination Control Program: A Case Study of Balancing Cost, Schedule and Risk

Hansen, Patricia A.; Day, Diane T.; Secunda, Mark S.; Rosecrans, Glenn P.; 23rd Space Simulation Conference Proceedings; [2005]; 34 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Swift Observatory will be launched in early 2004 to examine the dynamic process of gamma ray burst (GRB) events. The multi-wavelength Observatory will study the GRB afterglow characteristics, which will help to answer fundamental questions about both the structure and the evolution of the universe. The Swift Observatory Contamination Control Program has been developed to aid in ensuring the success of the on-orbit performance of two of the primary instruments: the Ultraviolet and Optical Telescope (UVOT) and the X-Ray Telescope (XRT). During the design phase of the Observatory, the contamination control program evolved and trade studies were performed to assess the risk of contaminating the sensitive UVOT and XRT optics during both pre-launch testing and on-orbit operations, within the constraints of the overall program cost and schedule.

Author

Astronomical Satellites; Project Management; Contamination; Satellite-Borne Instruments; Ultraviolet Telescopes; X Ray Telescopes

20050203922 Colombo Univ., Colombo, Sri Lanka

An Experience in the Evaluation of E-learning for it Training and Certification

An, Louiza; Restrepo, Luis G.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 5 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Looking to promote within the country a socially wide ranging IT exposure that would be sustainable and have a positive impact on the country's development, the Colombian Government was inspired by India's experience in the development of its own successful Information Technology sector and went on to construct a programme called the Connectivity Agenda. This programme is comprised of the following six strategies: infrastructure access; education and training; e-commerce; e-government; boosting the IT industry and increasing Colombia's website coverage. One of the components of the Education and Training strategy is the National Project of Training and Certification in Information Technology which looks to train, to an international standard, some 5000 professionals within 7 years. After a year of development the Project's advances were evaluated in various cities around the country. Using the evaluation from one of those cities we have set out the following, principal results which can act as a reference for other countries who wish to implement similar IT projects.

Author

Certification; Education; Industries; Information Systems

20050203931 Advanced Pedagogical Univ., Caracas, Venezuela

Planning in Practice

Kusch; Rebollo; Ryan; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 18 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are several tasks at hand in this paper. What brought us together as a group was the desire to organize an action research event in Venezuela. It is debatable whether we might agree on a single account of what actually took place in Venezuela, or on an account of our preliminary work. Consequently you will see how our different perspectives illustrate facets of our work and what the implications might be for others coming together, within action research, to carry out a joint task. Our data is taken from audio-recordings of our planning meetings, from the event we presented and from extensive e-mail correspondence since then. We will start by describing the background to the events we will describe, the planning process we went through, some factors we considered in our planning, and some of the outcomes from the event. We hope to: show the complexity of planning in practice; show the variety of outcomes for the people involved in the Events; and, suggest ways that models of planning for action research might be revised. While our context may seem unusual, this strangeness helps problems some of the generic issues in multi-national planning for action research.

Author

Electronic Mail; Network Analysis; Planning

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DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20050199685 Federal Library and Information Center Committee, Washington, DC, USA

Handbook of Federal Librarianship. Revised January 2004

Jan. 2004; 78 pp.; In English

Report No.(s): PB2005-108537; No Copyright; Avail: CASI; [A05](#), Hardcopy

The Handbook of Federal Librarianship is a project of the Federal Library and Information Center Committee (FLICC) Education Working Group. Committee members are primarily a group of federal librarians with a few federal employees who hold positions in federal libraries and information centers. All chapters of the handbook have been revised and updated for this second edition. In keeping with the charge of the original Task Force we offer this handbook as a resource tool for librarians new to the federal community and a quick reference guide for established federal librarians. The Federal Librarians Handbook is written for professional librarians and is therefore not intended as a manual to instruct you on how to be a librarian. Instead it focuses on the federal angle of other-wise standard practices and procedures of good librarianship. A topic was omitted if it was determined not to have anything uniquely federal about it. An exception was made for the chapter on 'copyright' because it remains a challenging and continuously developing topic for all librarians.

NTIS

Handbooks; Libraries

20050199687 Environmental Protection Agency, Cincinnati, OH, USA

Security Information Collaboratives: A Guide for Water Utilities

Mar. 2005; 44 pp.; In English

Report No.(s): PB2005-108391; EPA/625/R-05/002; No Copyright; Avail: CASI; [A03](#), Hardcopy

Water infrastructure-related emergencies can vary greatly in their severity and extent. They can run the gamut from waterborne disease outbreaks and vandalism to terrorist threats and actions suddenly made conceivable by the events of September 11, 2001. Drinking water and wastewater utilities have been working harder than ever to improve or maintain security. Information about potential threats to these systems-and the appropriate responses to those threats-is essential to the success of any security improvements. Drinking water and wastewater utilities can work with each other, state primacy agencies, the public health community, and law enforcement and other first responders to collect and share pertinent information. This guide offers suggestions on how to establish a successful security-information collaborative. In preparing the guide, the U.S. Environmental Protection Agency (EPA) drew on the experiences of established security-information collaboratives across the country.

NTIS

Environment Protection; Potable Water; Security; Utilities; Waste Water

20050200830 Space and Naval Warfare Systems Command, Charleston, SC USA

Subversion as a Threat in Information Warfare

Anderson, Emory A.; Irvine, Cynthia E.; Schell, Roger R.; Jun. 2004; 13 pp.; In English

Report No.(s): AD-A435312; No Copyright; Avail: CASI; [A03](#), Hardcopy

As adversaries develop Information Warfare capabilities, the threat of information system subversion presents a significant risk. System subversion will be defined and characterized as a warfare tool. Through recent security incidents, it is shown that means, motive, and opportunity exist for subversion, that this threat is real, and that it represents a significant vulnerability. Mitigation of the subversion threat touches the most fundamental aspect of the security problem: proving the absence of a malicious artifice. A constructive system engineering technique to mitigate the subversion threat is identified.

DTIC

Information Systems; Warfare

20050200838 Georgia Inst. of Tech., Atlanta, GA USA

Ultra-High Capacity Holographic Memories

Adibi, Ali; Fekri, Faramarz; McLaughlin, Steven W.; Nov. 2004; 57 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0053

Report No.(s): AD-A435354; AFRL-SR-AR-TR-05-02-58; No Copyright; Avail: CASI; [A04](#), Hardcopy

This report summarizes the achievements at Georgia Institute of Technology in the area of ultra- high capacity holographic memories funded by Air Force Office of Scientific Research (AFOSR) during the period of December 1, 2001 to October 1, 2004. The primary goal of this research has been to enhance the technologies that will enable the design of ultra-high capacity bulk memories based on the unique properties of volume holographic storage. Such memories have a short access time, a high data transfer rate, and a high storage capacity. In these memories, data is stored in two-dimensional arrays of ones and zeros that are recorded as pages in a holographic material. These data pages can be multiplexed to occupy the same holographic volume. The individual data pages are read by selecting either the angle or the wavelength of the reference beam. Furthermore, the readout from these memories is extremely fast because of the parallelism that is inherent in their large data pages. To take advantage of the advancement in making spatial light modulators with ultra-small pixels, we need to solve the problem of limited spatial bandwidth of the storage material. This limitation puts an upper bound on the smallest pixel size that can be recorded. However, by modulation of the pixel size (while keeping the size above the smallest acceptable value) or modulation of the pixel position using constrained coding, we can improve the number of available bits per page. On the other hand, the data cannot be read out without errors and the bit- error rate varies as a function of the position of the data within the crystal. To get the overall bit-error rate below an acceptable level for bulk storage (less than 10^{-12}) will require error control coding.

DTIC

Computer Storage Devices; Data Storage; Holography; Information Transfer

20050200869 Naval Postgraduate School, Monterey, CA USA

An Approach to Security Requirements Engineering for a High Assurance System

Irvine, Cynthia E.; Levin, Timothy; Wilson, Jeffery D.; Shifflett, David; Pereira, Barbara; Jan. 2002; 22 pp.; In English

Report No.(s): AD-A435464; No Copyright; Avail: Defense Technical Information Center (DTIC)

Requirements specifications for high assurance secure systems are rare in the open literature. This paper examines the development of a requirements document for a multilevel secure system that must meet stringent assurance and evaluation requirements. The system is designed to be secure yet combines popular commercial components with specialized high assurance ones. Functional and non-functional requirements pertinent to security are discussed. A multi-dimensional threat model is presented. The threat model accounts for the developmental and operational phases of system evolution and for each phase accounts for both physical and non-physical threats.

DTIC

Computer Information Security; Requirements; Security

20050200871 Xerox Corp., Palo Alto, CA USA

Cosense: Collaborative Sensemaking of Distributed Data for Recognition and Condition Monitoring

Reich, James; Liu, Juan; Chu, Maurice; Cheung, Peter; Jun. 2005; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0139; Proj-K250

Report No.(s): AD-A435466; AFRL-IF-RS-TR-2005-213; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report summarizes PARC's work on collaborative sense making under the DARPA SensIT program. The report is divided into two parts. Part I summarizes the original contract work which was centered on topics such as distributed multi-level feature analysis, distributed hypothesis management, and scaling metrics for distributed sensors. An extensive bibliography of the detailed papers resulting from this work is provided. Part II describes the work under the two contract extension where we proposed a distributed attention approach, spreading tasks through the network and filtering out the subset of useful data close to the data sources, proceeding from signals to symbols as we progress from data source to end user. Our architecture separates concerns of how and where to acquire the data from issues of processing. Data interpretation is separated into layers with clear interfaces. Testbed and simulations of the architecture and various algorithms are documented here.

DTIC

Bibliographies; Distributed Processing

20050200883 Naval Postgraduate School, Monterey, CA USA

Information Sharing About International Terrorism in Latin America

Castillo Arias, Jaime O.; Jun. 2005; 79 pp.; In English

Report No.(s): AD-A435495; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of the thesis is to analyze the importance of sharing information when dealing with activities related to international terrorism in Latin America, especially in the aftermath of the terrorist events against the USA on September 11, 2001. The importance of information on international terrorism is critical in the war against terrorism, particular in the region due to the potential for those activities associated with the already existent organized crime. The importance of information includes organizations. Therefore, the proposed organizational process makes it possible to facilitate the sharing of information considering the complexity involved. At the same time, the necessity of information about the threat of terrorism can be demonstrated through the use of game theory. This model can drive the states to use all means necessary to obtain relevant information. The requirement for information sharing must be solved based on the relevance of the threats and the need for increased security for the states in the region.

DTIC

Central America; Game Theory; South America; Terrorism

20050200917 Naval Postgraduate School, Monterey, CA USA

Geo-Demographic Analysis in Support of the USA Army Reserve (USAR) Unit Positioning and Quality Assessment Model (UPQUAM), Part II

Tatro, Gary S.; Jun. 2005; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435564; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis is the second part of a three-part thesis study that was started by LTC Martin Fair in June 2004. In his initial thesis, LTC Fair built a database by joining information from the U.S. Census Bureau, U.S. zip codes, and USAR zip code data. LTC Fair also formulated a network flow model and began an initial implementation of the first of many constraints. My thesis will validate the constraint models and develop the set of constraints that another project, by LTC Brau, will need to develop the network flow model. That model will optimize reserve unit readiness in the third and perhaps final part of the study. Since the early 1990's and the demise of the Cold War, the USA Army active and reserve forces have undergone dramatic restructuring. The Active component was reduced in size from 18 active divisions down to today's total of ten - a force cut of approximately 300,000 soldiers. Additionally, the USA Army Reserve forces mission shifted to a predominately Combat Support (CS) and Combat Service Support (CSS) mission. This realignment was an attempt to use the USAR component in a support role as the world situation dictated. Since the terrorist attacks of September 11, 2001, and the subsequent declaration of a War on Terrorism, the USA Army Reserve (and active component) has been called upon to deploy more frequently and for extended periods of time. Maintaining unit readiness and a satisfactory 'fill-rate' is probably one of the leading challenges that our reserve forces face. This thesis examines the relationship between unit location and recruiting success. We seek to maximize the fill rate of USA Army Reserve (USAR) units. Our method will correlate the vocational aptitudes of the US population with the Military Occupational Specialties (MOS) of the USAR units.

DTIC

Combat; Contract Incentives; Marketing; Military Operations; Military Personnel; Positioning; Support Systems; Terrorism; United States

20050200991 Defense Acquisition Univ., Fort Belvoir, VA USA

Protecting Noncreative Databases: H.R. 3261, 108th Congress, First Session (2003)

Jeweler, Robin; Jan. 2004; 6 pp.; In English

Report No.(s): AD-A435702; CRS-RS21662; No Copyright; Avail: Defense Technical Information Center (DTIC)

Copyright law protects works of authorship that exhibit original, creative expression, including creativity in the selection, arrangement, or coordination of both traditional and automated databases. Noncreative databases are not subject to protection against copying under existing copyright law. Database producers seek new legal protection against piracy of collections of information that result from the investment of substantial amounts of money, time, or other resources. The protection they seek would be based on industrious effort rather than on creativity. This report examines the pending legislative proposal, H.R. 3261, which, if enacted, would create a misappropriation-style of protection against the copying of all or a substantial part of such collections of information.

DTIC

Copyrights; Data Bases

20050200994 Defense Acquisition Univ., Fort Belvoir, VA USA

Safe Harbor for Service Providers Under the Digital Millennium Copyright Act

Yeh, Brian; Jeweler, Robin; Jan. 2004; 20 pp.; In English

Report No.(s): AD-A435712; CRS-RL32037; No Copyright; Avail: Defense Technical Information Center (DTIC)

Congress passed the Digital Millennium Copyright Act (DMCA) in 1998 in an effort to adapt copyright law to an evolving digital environment. The expansive legislation is divided into five titles, the second of which is the focus of this report. Title II of the DMCA amended chapter 5 of the Copyright Act, 17 U. S.C. 501 et seq., and created a new 512 to limit the liability of service providers for claims of copyright infringement relating to materials on-line. This 'safe harbor' immunity is available only to parties that qualify as a 'service provider' as defined by the DMCA, and only after the provider complies with certain eligibility requirements. In exchange for immunity from liability, the DMCA requires service providers to cooperate with copyright owners to address infringing activities conducted by the providers' customers. Subsection 512(h) obligates service providers to divulge to copyright owners the identity of a subscriber suspected of copyright infringement. The subsection provides a detailed procedure that a copyright owner must follow in order to obtain a subpoena from a federal court compelling the service provider to reveal the identity of the suspected infringing user. This report describes the safe harbor and subpoena provisions, along with the responsibilities and obligations of service providers under 17 U.S.C. 512. In addition to highlighting specific aspects of the statutory text, the report examines case law to date interpreting and applying the DMCA's safe harbors and subpoena procedure.

DTIC

Copyrights; Harbors; Law (Jurisprudence)

20050200998 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Shock User's Manual Version 1.0

Wager, Philip; Apr. 2005; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435720; NFESC-UG-2065-SHR; No Copyright; Avail: Defense Technical Information Center (DTIC)

SHOCK is a blast load analysis program, which will calculate the impulse and pressure on all or part of a blast surface, which is bounded by 1 to 4 reflecting surfaces. SHOCK will read input from a program data file or a Blast Library Database. The input can also be entered interactively. The required input is the length and width of the blast surface, the number and location of the reflecting surfaces and the weight and location of the charge. SHOCK calculates the impulse and pressure on either all or part of the blast surface from the incident blast wave and from the waves reflecting off of each adjacent surface. SHOCK uses these results to calculate the maximum average pressure on the blast surface from each incident and reflected wave, and the total average impulse from the sum of all the waves. SHOCK also calculates the impulse duration on the blast surface.

DTIC

Blast Loads; Computer Programs; Manuals; User Manuals (Computer Programs)

20050201012 Air Force Research Lab., Brooks AFB, TX USA

Usability Improvement for Data Input into the Fatigue Avoidance Scheduling Tool (FAST)

Miller, James C.; May 2005; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A435739; AFRL-HE-BR-TR-2005-0072; AFRL-HE-BR-TR-2005-0072; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Fatigue Avoidance Scheduling Tool (FAST(TradeMark)) was a Windows(registered) program based upon the SAFTE applied fatigue model. FAST(TradeMark) allowed planners and schedulers to estimate the average effects of various schedules

on human performance. It allowed work and sleep data entry in graphic, text and symbolic formats. We had set an objective to 'Demonstrate fatigue management software interface improvements to achieve 20% increase in usability for field personnel.' We hypothesized that data entry would be accomplished significantly faster by novice and expert users using the symbolic (grid) data input mode than using the graphic schedule input mode. The Grid input mode provided both a statistically and an operationally significant reduction in data input time, compared to the Graphic mode for both novice and expert users. We concluded that the Grid input mode offered a 40 to 45% reduction in FAST(TradeMark) data input time, compared to the default Graphic input mode. This enhancement of data input speed was probably due to the need for fewer discrete input actions (keystroke and mouse). The Grid mode also appeared to be more intuitive for novice users than the Graphic input mode.

DTIC

Scheduling

20050201032 Defense Acquisition Univ., Fort Belvoir, VA USA

H.R. 1417: The Copyright Royalty and Distribution Reform Act of 2004

Jeweler, Robin; Apr. 2004; 6 pp.; In English

Report No.(s): AD-A435777; CRS-RS21512; No Copyright; Avail: Defense Technical Information Center (DTIC)

The owner of a copyright generally has the exclusive right to control use and distribution of the protected work. One who wishes to use the protected work ordinarily gets permission directly from the owner (or his or her agent). The permission may take any number of forms, a common one being a license agreement. There are several provisions in the Copyright Act that create 'statutory' or compulsory licenses. In these situations, a user need not obtain permission for use from the copyright owner; permission is 'compulsory'. The user or licensee must abide by statutorily imposed conditions and pay prescribed royalties. Among the statutory licenses created in the Copyright Act are licenses to make and distribute phonorecords (mechanical licenses) ; licenses for use of certain works by noncommercial broadcasters ;2 and, licenses for specified secondary transmissions by cable television and satellite carriers. A more recent class of compulsory licenses covers digital transmissions of sound recordings, which includes webcasting.

DTIC

Copyrights; Telecommunication

20050201071 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

CuPIDS: An Exploration of Highly Focused, Co-Processor-Based Information System Protection

Williams, Paul D.; Spafford, Eugene H.; May 2005; 22 pp.; In English

Report No.(s): AD-A435852; AFIT-CI04-1129; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Co-Processing Intrusion Detection System (CuPID S) project is exploring how to improve information system security by dedicating computational resources to system security tasks in a shared resource, multi-processor (MP) architecture. Our research explores ways in which this architecture offers improvements over the traditional uni-processor (UP) model of security. There are a number of areas to explore, one of which has a protected application running on one processor in a symmetric multiprocessing (SMP) system while a shadow process specific to that application runs on a different processor, monitoring its activity, ready to respond immediately if the application violates policy. Experiments with a prototype Cu- PIDS system demonstrate the feasibility of this approach. Fine-grained protection of the real-world application WU-FTP resulted in less than a ten percent slowdown while demonstrating CuPIDS' ability to quickly detect illegitimate behavior, raise an alarm, automatically repair the damage done by the fault or attack, allow the application to resume execution, and export a signature for the activity leading up to the error.

DTIC

Detection; Information Systems; Protection; Security; Warning Systems

20050201108 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Toward Omniscient command: How to Lead in the Information Age

Jensen, William P.; May 2005; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A435944; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study examines information age leadership in the U.S. Armed Forces, and presents specific skills that will enhance future military operations in the information age. The following issues related to information age leadership are investigated: historical background, its nature and dynamics, significant factors, and doctrine covering information management and leadership. The multi-pronged approach will serve as the catalyst to a better understanding of information age leadership and

the development of applicable skills. The study begins with a historical analysis of selected wars spanning the history of humankind. The following conflicts are analyzed in terms of leadership: Peloponnesian Wars, Napoleonic Warfare, the American Civil War, World War II, and Operation Allied Force. The analysis focuses primarily on how commanders receive and use information, and how it affects their leadership. The study also includes a review and analysis of joint and service-specific leadership doctrine. Through this review, the author examines what the military's doctrinal position is on leadership and information management, and identifies the doctrine's leadership skill shortfalls. The study also places these leadership skills in the context of the Joint Operating Environment (JOE) to determine how they will answer the challenges of the anticipated dynamic combat environment. The study concludes with an extended description of those leadership skills required to lead effectively in the information age. It is clear that the U.S. Armed Forces must develop new leadership doctrine that reflects the skills needed to dominate adversaries in the information age.

DTIC

Data Processing; Information Management; Leadership; Management Planning

20050201608 Naval Air Warfare Center, Orlando, FL USA

Quality Evaluation Tool for Computer-and Web-Delivered Instruction

Hays, Robert T.; Stout, Renee J.; Ryan-Jones, David L.; Jun. 2005; 175 pp.; In English

Report No.(s): AD-A435294; TECHNICAL REPORT-2005-002; No Copyright; Avail: CASI; [A08](#), Hardcopy

The objective of this effort was to develop an Instructional Quality Evaluation Tool to help instructional developers and instructional program managers quantitatively determine the quality of their instructional products, both during development and at project completion. The Tool can also support the comparison of courseware from different developers or courseware that uses different combinations of instructional media. Likert scaling techniques were used to develop 5-point rating scales for each evaluation criterion. Anchor descriptions were developed for each rating point on all scales. This report includes these anchored Likert scales, which can serve as a 'stand-alone' Tool. The evaluation criteria are organized into two major sections: instructional features and user-interface design. For those who with additional information or with to conduct a more 'in-depth' evaluation, the detailed discussions of each evaluation criterion include definitions of important terms and summaries of the literature that supports the criterion. The discussions also provide suggested techniques to improve courseware by optimizing the instruction from the perspective of each criterion. Recommendations for future improvement of the Tool are provided.

DTIC

Computer Assisted Instruction; Education; Educational Resources; Internets; Pulse Rate; Quality; Scales

20050201621 Naval Postgraduate School, Monterey, CA USA

A Cautionary Note Regarding the Data Integrity Capacity of Certain Secure Systems

Irvine, Cynthia E.; Levin, Timothy E. ; Jan. 2002; 24 pp.; In English

Report No.(s): AD-A435460; No Copyright; Avail: Defense Technical Information Center (DTIC)

The need to provide standard commercial-grade productivity applications as the general purpose user interface to high-assurance data processing environments is compelling, and has resulted in proposals for several different types of 'trusted' systems. We characterize some of these systems as a class of architecture. We discuss the general integrity property that systems can only be trusted to manage modifiable able data whose integrity is at or below that of their interface components. One effect of this property is that in terms of integrity these hybrid-security systems are only applicable to processing environments where the integrity of data is consistent with that of low-assurance software. Several examples are provided of hybrid-security systems subject to these limitations.

DTIC

Security; Data Processing; Warning Systems; Productivity

20050201659 Defense Acquisition Univ., Fort Belvoir, VA USA

Digital Rights and Fair Use in Copyright Law

Jeweler, Robin; Mar. 2003; 17 pp.; In English

Report No.(s): AD-A435718; CRS-RL31827; No Copyright; Avail: Defense Technical Information Center (DTIC)

Consumers have never been as deeply involved in the nuances of copyright law and as directly impacted by copyright infringement litigation as they are today. As a consequence of litigation, popular means of access to digital entertainment media may be foreclosed or dramatically altered. While the public audience for digital 'consumption' of entertainment grows, the law and technology increasingly focus on digital means to protect copyright interests because of the great risk of piracy

inherent in digital media exchanged over the Internet. Consumers have reacted vociferously to new limitations imposed or proposed by new technological constraints. Many content users argue that new limitations on access to copyrighted materials impair their right to 'fair use.' But the contours of fair use as personal, noncommercial use by end users, i.e., consumers, in a digital environment and over the Internet have not been fully established or articulated by the courts. Arguably, this process is in its early stages. This report examines judicial case law which has considered the doctrine of fair use in relation to the First Amendment, the Digital Millennium Copyright Act, and as a means of protecting private, noncommercial use of digital music and film by consumers. It concludes that when the potential to infringe is great, as it almost always will be in a digital environment, the courts have not been willing to expand fair use to encompass subsidiary uses such as time shifting, space shifting, or personal noncommercial use.

DTIC

Copyrights; Media; Consumers

20050201707 National Inst. of Information and Communications Technology, Tokyo, Japan

Data Center at NICT

Koyama, Yasuhiro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 178-181; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Data Center at National Institute of Information and Communications Technology archives and releases te databases and analysis results processed at the Correlation Center and the Analysis Center at National Institute of Information and Communications Technology, Regular VLBI sessions with the Key Stone Project VLBI Network were the primary objects of the Data Center. These regular sessions continued until the end of November 2001. In addition to the Key Stone Project VLBI sessions, National Institute of Information and Communications Technology has been conducting geodetic VLBI sessions for various purposes and these data are also archived and released by the Data Center.

Author

Correlation; Data Bases; Very Long Base Interferometry; Information Systems; Geodesy

20050201708 Observatoire de Paris, France

Paris Observatory (OPAR) Data Center

Essaifi, Najat; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 182-184; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the OPAR Data Center activities over 2004. Included is information about functions, architecture, status, future plans and staff members of OPAR Data Center.

Author

Observatories; Very Long Base Interferometry; Data Systems

20050201766 Bundesamt fuer Kartographie und Geodaesie, Germany

BKG Data Center

Thorandt, Volkmar; Wojdziak, Reiner; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 171-172; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities and background information of the IVS Data Center for the year 2004. Included are information about functions, structure. technical equipment and staff members of the BKG Data Center.

Author

Geodesy; Very Long Base Interferometry; Data Bases; Data Base Management Systems

20050201768 National Inst. of Information and Communications Technology, Japan

Technology Development Center at NICT

Kondo, Tetsuro; Koyama, Yasuhiro; Takeuchi, Hiroshi; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 272-275; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

National Institute of Information and Communications Technology (NICT) has led to the development of VLBI technique in Japan and has been keeping high activities in both observations ad technical developments. This report gives a review of

the Technology Development Center (TDC) at NICT and summarizes recent activities.

Author

Information Systems; Very Long Base Interferometry; Technology Utilization; Telecommunication

20050201770 IPSI BgD Internet Research Society, New York, NY, USA

The IPSI BgD Transactions on Advanced Research, Volume 1, Number 1

Milutinovic, Veljko, Editor; Flynn, Michael, Editor; Karabeg, Dino, Editor; Domenici, Andrea, Editor; Kiong, Tan Kok; Blaisten-Barojas, Estela, Editor; Milligan, Charles, Editor; Jutla, Dawn, Editor; Furht, Borko, Editor; Gonzalez, Victor, Editor, et al.; January 2005; ISSN 1820-4511; 92 pp.; In English; See also 20050201771 - 20050201782; Original contains color illustrations; Copyright; Avail: CASI; [A05](#), Hardcopy

The IPSI BgD Transactions on Advanced Research is presented. The topics include: 1) Wisdom of Education for Globalization; 2) Issues in Wireless Security Based on AES Hardware Implementation; 3) Programming Language Concepts for Global Computing; 4) Information Extraction from Texts: Adapting a System for Summarization of News Reports to the Domain of Bioinformatics; 5) easyTransport: An Interoperable and Secure e-ticketing Model based on Contactless Smart Cards; 6) Adaptive Collaboration: The Road Map Leading Telework to a More Advanced and Professional Working Format; 7) Molecular Processes as a Basis for Autonomous Networking; 8) H1B Visa and the Policy Vignette for 21st Century Dislocated Workers in the USA; 9) Factors affecting supplier adoption of governmental reverse auctions: an exploratory case study; 10) Quantifying the Learning Efficiency of Programming Learning and It's Implications; 11) Agile Systems for Clinical Research; and 12) Reasoning Procedure and Implementation for Logic Programs as Managing Schemes to Extract Demand. CASI

Internets; Computers; Research Projects; Information Systems

20050201775 Skovde Univ., Sweden

Information Extraction from Texts: Adapting a System for Summarization of News Reports to the Domain of Bioinformatics

Gawronska, Barbara; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 20-28; In English; See also 20050201770; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

Natural language serves as important information source in all areas of human activity. The presence of a huge amount of texts on the Internet actualizes the problem of efficient information search; visual scanning of all the textual information is difficult and time-consuming. There is a need for efficient, high-quality systems that extract the relevant information from texts. The paper presents the architecture of an experimental system for automatic text understanding and information extraction, which has originally been developed for the domain of news reports. The possibility of adapting the methodology for the purpose of bioinformatics is discussed, and the similarities and differences between texts in the two different domains are discussed and exemplified.

Author

Information Retrieval; Information Systems; Natural Language (Computers)

20050201803 Consiglio Nazionale delle Ricerche, Italy

A Distributed Multimedia Information System for Cultural Heritage Identity Preservation

Aiello, Aldo; Furnari, Mario Mango; Massarotti, Antonio; The IPSI BgD Transactions on Internet Research; January 2005, pp. 11-17; In English; See also 20050201801; Original contains black and white illustrations

Contract(s)/Grant(s): C29/M3P12; Copyright; Avail: CASI; [A02](#), Hardcopy

In this paper we describe the architecture of a Distributed Content Management System developed to organize the cultural information in such a way that the cultural identity of a community could be easily communicated. One of the major problems investigated was how the information integration could simplify the relevant information looking for process. Here, the notion of contents community was developed, together with a set of tools, in order to organize the document information space. Each content provider publishes a set of ontologies, to collect metadata information, organized and published through the Contents Community Authority. These methodologies were deployed setting up a prototype that connects about 20 museums in the city of Naples (Italy).

Author

Multimedia; Distributed Processing; Management Information Systems; Culture (Social Sciences)

20050201809 Florida Atlantic Univ., Boca Raton, FL, USA

Using Technology to Conduct Research in Education

Wright, Dianne A.; The IPSI BgD Transactions on Internet Research; January 2005, pp. 90-93; In English; See also 20050201801; Copyright; Avail: CASI; [A01](#), Hardcopy

Technology has changed the way research is conducted by academicians in all disciplines. Unfortunately, however, the availability of research on this topic in the field of education, where one is more likely to find instructional technology as the focus of related research studies, is a problem. The author recommends solutions to this problem including not only an increased focus on the availability of such technologies, but also the extent to which these technologies are used by educators as well as their perspectives regarding concomitant advantages and disadvantages. The fact that such technologies are coming into existence as fast as they can be documented, while but one limitation noted, is more reason for comparative analyses that can be used to inform next generation technologies.

Author

Education; Technologies; Research; World Wide Web

20050201810 Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

An Information Retrieving Service for Distance Learning

Nakayama, Lauro; Vicari, M. Rosa; Coelho, Helder; The IPSI BgD Transactions on Internet Research; January 2005, pp. 49-56; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

The Lifelong Learning environment has specific features and it is strongly supported by Information and Communication Technologies. Our idea consists of a web service to aid the student along the information retrieval and mining process. The service is supported by three different agents. The user profile, the student model and the intelligent information mining process. This information permits us to generate a refined search term according to the student's needs, which occurs during the solution of a problem. The main advantage of this service is a refined search result that can aid the student in his educational activities. This service composes the kernel of the Web educational portal - PortEdu.

Author

Information Retrieval; Telecommunication; Machine Learning

20050201811 Turku Univ., Finland

Critical Skills and Knowledge in Development of e-commerce Infrastructure

Sirkemaa, Seppo J.; The IPSI BgD Transactions on Internet Research; January 2005, pp. 73-80; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

In general, information systems development is based on existing systems. This is also the case with information technology infrastructure (IT infrastructure) because all earlier development work and decisions impact the reliability and flexibility of the infrastructure. This makes management of IT infrastructure development an important challenge. Information systems rely on infrastructure in sharing data and information. Here we focus on IT infrastructure and discuss what skills and knowledge is needed in development of e-commerce infrastructure for the company. We argue that the skills and knowledge of persons involved in the development process is a critical resource.

Author

Electronic Commerce; Information Systems; Systems Engineering

20050201813 Tokyo Univ., Japan

Access Control for e-Business on MOPASS

Shin, Kilho; Taguchi, Masahiro; The IPSI BgD Transactions on Internet Research; January 2005, pp. 65-72; In English; See also 20050201801; Original contains black and white illustrations; Copyright; Avail: CASI; [A02](#), Hardcopy

MO(bile)PASS(port) is a consortium lead by Japanese major electric appliance manufacturers for the next-generation smart card. Its scope includes the software middleware that bridges between the smart card and real e-Businesses. In fact, the specification of Ticket Authentication Protocol, which provides access control functionality applicable to a wide range of e-Businesses (e.g. digital ticketing, digital content distribution), is under consideration by MOPASS. The specification is open and direct since it is based on a new methodology characterized by user's access-rights being straightforwardly authenticated by PKI. In addition, it covers the functionality of revoking, duplicating and transferring of access-rights in a peer-to-peer manner.

Author

Access Control; Computer Information Security; Electronic Commerce

20050201956 Bureau of Reclamation, Denver, CO, USA

Geographic Information Systems Comparisons of Hardware and Data Entry Methods

Bell, A.; Whitesell, B.; Feb. 1993; 18 pp.; In English

Report No.(s): PB2005-107610; No Copyright; Avail: CASI; [A03](#), Hardcopy

GIS (Geographic Information Systems) use computer technology to provide a convenient method to input and store vast amounts of locationally defined information, retrieve and manipulate the stored data, and output the data in the form of maps and tables (Williamson, 1992). Like many Government agencies, Reclamation (Bureau of Reclamation) has been using GIS technology for over 10 years. The Section (Remote Sensing and Geographic Information Section) has used ARC/INFO GIS software, from ESRI (Environmental Systems Research Institute, Inc.), for numerous projects. Applications include, but are not limited to, reservoir water quality studies, environmental change detection studies, and resource management plans. For many years, GIS technology has been available only to those with access to mainframe or minicomputers, expensive software, and the personnel to run the systems. The development of powerful PCs (personal computers), UNIX workstations, and moderately priced software is allowing for a tremendous proliferation of GIS technology. Many of Reclamation's offices are embracing GIS and want to develop in-house capabilities. These offices have requested the assistance of the Section's staffing determining the best GIS hardware/software combination for their needs.

NTIS

Geographic Information Systems; Information Systems

20050203793 NASA Glenn Research Center, Cleveland, OH, USA

NASA Space Mechanisms Handbook and Reference Guide Expanded Into CD-ROM Set

Fusaro, Robert L.; Research and Technology 2001; March 2002; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

NASA has been involved with the design, fabrication, testing, and operational use of space mechanisms since the earliest years of space exploration. Drawing upon the vast base of knowledge amassed since that time and in recognition of the maturity of the development of space mechanisms, a Space Mechanisms Handbook was written at the NASA Glenn Research Center that details the state-of-the-art in space mechanisms design as of 1998. NASA's objective in developing this Space Mechanisms Handbook was to provide readily accessible information on such areas as space mechanisms design, mechanical component availability and use, testing and qualification of mechanical systems, and a listing of worldwide space mechanisms experts and testing facilities in the USA. Recently, researchers at Glenn expanded the Handbook into a two-volume CD-ROM set in an Adobe Acrobat format.¹ In addition to the handbook, the CD's include (1) the two volume Space Mechanisms Lessons Learned Study, (2) proceedings from all the NASA hosted Aerospace Mechanisms Symposia held through the year 2000, (3) the Space Materials Handbook, (4) the Lubrication Handbook for the Space Industry, (5) the Structural & Mechanical Systems Long-Life Assurance Design Guidelines, (6) the Space Environments and Effects Source-Book, (7) the Spacecraft Deployable Appendages manual, (8) the Fastener Design Manual, (9) A Manual for Pyrotechnic Design, Development and Qualification, (10) the Report on Alternative Devices to Pyrotechnics on Spacecraft, and (11) Gearing (a manual). In addition, numerous other papers on tribology and lubrication are included. By placing all these research and application results in a single, searchable CD-ROM set, we believe that we have provided a powerful information resource to technical personnel working on space mechanical applications. In addition, we believe that this CDROM set will be a permanent reference resource for future space mechanisms work. The NASA Space Mechanisms Handbook and Reference Guide is available in either print or CD versions to qualified requestors who are U.S. Citizens.

Author

Aerospace Engineering; Handbooks; Manuals; CD-ROM

20050203824 Charles Darwin Univ., Darwin, Australia

The Place Of The Internet In Research Into The History Of Science: Three Case Studies

Palmer, William P.; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 11 pp.; In English; See also 20050203815; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper relates to the study of the history of science, in situations where geographical circumstances such as in the Northern Territory of Australia, limit access to resources. In earlier times only those living in reasonable proximity to the great libraries of the world were able to undertake this research. In the past this researcher would return to Britain and spend a week or so in the British Library, London or the Bodleian, Oxford and visit bookshops, particularly in Hay-on-Wye to obtain enough materials for the following year. Utilising three case studies selected from the recent work of the author, it will be observed

that research in the history of science is now possible almost irrespective of geography, provided the researcher has internet access.

Author

Geography; Internets; Libraries

20050203832 Technische Univ., Berlin, Germany

Generic Intelligent Personal Information Agent

Albayrak, Sahin; Milosevic, Dragan; International Conference on Advances in Infrastructure for Internet, Processing, Systems, and Interdisciplinaries (IPSI-2004); [2004]; 14 pp.; In English; See also 20050203815; Original contains black and white illustrations; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The aim of this paper is to present one personalization model being based on generic modeling mechanisms through which specialization, profile adaptation and exploration are deployed. While for the user's specialization one novel adaptable feature weighting scheme is developed, the exploration of new information areas is achieved through the application of attribute collaborative filtering. The strength of the developed personalization model is the possibility to support systems in different application domains. Its applicability is already proved in the sensitive domain of recommending travel offers, and it is on a good way to be also proved in the personal information retrieval.

Author

Information Retrieval; Support Systems; Domains; Deployment

20050203905 Nervana, Inc., Bellevue, WA, USA

The Information Nervous System, Volume 1

Omoigui, Nosa; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 20 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The explosive growth of digital information is increasingly impeding knowledge-worker productivity due to information overload. Online information is virtually doubling every year and most of that information is unstructured usually in the form of text. Traditional search engines have been unable to keep up with the pace of information growth primarily because they lack the intelligence to understand, semantically process, mine, infer, connect, and contextually interpret information in order to transform it to and expose it as knowledge. Furthermore, end-users want a simple yet powerful user-interface that allows them to flexibly express their context and intent and be able to ask natural questions on the one hand, but which also has the power to guide them to answers for questions they wouldn't know to ask in the first place. Today's search interfaces, while easy-to-use, do not provide such power and flexibility. In this paper, the first volume of several, I introduce an end-to-end system and resulting knowledge medium, the Information Nervous System that addresses precisely these problems. The system provides intelligent and dynamic semantic indexing and ranking of information (without requiring formal semantic markup), along with a semantic user interface that provides end-users with the flexibility of natural language queries (without the limitations thereof), without sacrificing ease-of-use, and which also empowers users with dynamic knowledge retrieval, capture, sharing, federation, presentation and discovery for cases where the user might not know what she doesn't know and wouldn't know to ask.

Author

Information Retrieval; Artificial Intelligence; Digital Data; Data Integration

20050203913 Chinese Univ. of Hong Kong, Hong Kong

EES: Assessment System to Evaluate the Information Technology Skills of Students - Prepare for Future Work in Accounting Industry

Kan, W. K.; Hui, K. W.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 5 pp.; In English; See also 20050203892; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Accounting is one of the earliest industries to apply Information Technology. Accounting has large penetration rate to use of Information Technology in the business sector. It is one of the largest groups of workforce working in this industry. It is well known that computer has the power to process and storage large amount of data. Therefore, it is more efficient to

computerize the accounting ledgers, which especially beneficial for large and medium size company. Assessment System is to evaluate students' Information Technology skills in order to prepare them for future work. The Assessment System can assist teachers to know whether the Information Technology skills for students are up to the skills for future work in accounting industry. It can also indicate the weakness of students and thus teachers and students can make improvement on these areas.

Author

Information Systems; Commerce; Students; Instructors

20050203936 Chinese Univ. of Hong Kong, Hong Kong

Evaluate Student's Information Technology Skill for Project based Learning through the Use of Web-based Information Technology Skill Assessment System

Kan, W. K.; Lee, T. S.; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 5 pp.; In English; See also 20050203892; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes the development of a web-based Information Technology skill assessment system. The main purpose of this project was to evaluate student's Information Technology skills in order to prepare them for project based learning. By the assessment system, teachers can know whether the Information Technology skills for the students are enough for their study purpose. It also indicates the weakness of students and thus teachers can tailor made the learning material for them so that their Information Technology skills are up to standard for their project based learning.

Author

Information Systems; Technology Assessment; World Wide Web; Students

20050203974 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands

Scenario-Based Evaluation of Communication Architectures in Operational Information Services

deJongh, J. F. C. M.; March 2005; 78 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): A04/CO/147; DO-13985; TNO Proj. 012.13985

Report No.(s): TD-2005-0281; Rept-33557; No Copyright; Avail: Other Sources

In military operations, providing all units in time with the information they require is both vital for operations and technically complicated. Firstly, the effectiveness of a unit depends for a large amount upon correct, up-to-date, and comprehensible information. Figuring out what information is needed by which unit and when is already a formidable task in itself. Secondly, since many units in military operations are mobile and/or equipped with only limited technical resources such as high-bandwidth, high-powered radios and accompanying energy sources, transferring this information from and to the units is far from trivial. Moreover, one usually needs to deploy wireless-communication networks which by nature are vulnerable to failures, for instance due to interference, jamming, or limited transmission ranges, and to unavailability, for instance due to radio-silence requirements. Unfortunately, the second problem is often overlooked due to the complexity of the first. The purpose of the research described in this report is therefore to significantly contribute to an understanding of the problem of limited communication capabilities, and, especially, to reducing the impact of communication failures and bandwidth and availability constraints. As such, this research attempts to bridge the gap between the two extremes of (1) considering the system as down when communication means fail or degrade, and (2) pretending the wireless communication systems will meet all conceivable requirements on availability and bandwidth, with negligible probability of breakdown or diminished performance.

Author

Military Operations; Information Systems; Communication Networks; Wireless Communication; Radio Equipment; Telecommunication

83

ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20050201780 California State Univ., Long Beach, CA, USA

H1B Visa and the Policy Vignette for 21st Century Dislocated Workers in the USA

O'Lawrence, Henry; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 51-56; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

An H1-B visa is considered an option for skilled professionals who are not U.S. Citizens or green card holders to get permission to work in the USA; a situation that is constantly affecting both individuals (called dislocated workers) and the US. companies. This reflects a huge gap between supply and demand in the American labor market in the area of high tech industry. This article discussed both the issues facing the H1B visa policy and the solution and the alternative solution. The entire issue of the H1B visa rests on one of control. Who will control the future of the US labor market? The high tech industry, like any other industry is in need of high tech workers, but does not want to pay an unprofitable price for them, or labor unions, who have historically exerted much leverage over the manufacturing industry in America, but now are losing in their struggle to maintain historically high U.S. wage levels in a global market.

Author

Labor; Occupation; Policies; United States; Economy

20050201782 Clemson Univ., SC, USA

Factors Affecting Supplier Adoption of Governmental Reverse Auctions: an Exploratory Case Study

Radhakrishnan, Abirami; Davis, Steve; Davis, Robert B.; The IPSI BgD Transactions on Advanced Research Volume 1, Number 1; January 2005, pp. 57-65; In English; See also 20050201770; Copyright; Avail: CASI; [A02](#), Hardcopy

Governmental reverse auctions have not been as widely adopted by suppliers as buyers expected. There is no prior study of this issue. Using an embedded case study, we found the following factors affect willingness to adopt governmental reverse auctions: a system factor (difficulty), perceived external factors (price based competition intensity, customer power and information intensity) and organizational readiness factors (financial readiness and technological readiness). Also we provided practitioners with suggestions to improve interaction with governmental reverse auctions.

Author

Governments; Economics

20050201807 Molde Coll., Molde, Norway

Broadband Infrastructure and Rural Regional Development in Norway

Molka-Danielsen, Judith; Ohren, Ottar; Jaeger, Bjorn; The IPSI BgD Transactions on Internet Research; January 2005, pp. 41-48; In English; See also 20050201801; Copyright; Avail: CASI; [A02](#), Hardcopy

This paper reports on findings of two surveys conducted in April 2001 and November 2002 on broadband infrastructure deployment and utilization of ICT services in 38 local governments of one county in Norway. Services include internal administrative services for the employees and services to the residents of the Communities. We examine how well actual adoption of services had met with expectations. Findings show adoption and use was not as pervasive as expected. Our study is compared to several other regional area studies carried out in Spain. We conclude this can be an inhibitor to this area's regional economic development.

Author

Broadband; Economic Development; Norway; Regions; Rural Areas

85

TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety*, *16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20050200974 RAND Corp., Santa Monica, CA USA

Building a Multinational Global Navigation Satellite System: An Initial Look

Michael Kennedy, Rosalind Lewis, Elham Gha; Jan. 2005; 119 pp.; In English

Report No.(s): AD-A435665; MG-284-AF; No Copyright; Avail: Defense Technical Information Center (DTIC)

The U.S. Global Positioning System (GPS), now the world's preeminent pointing, navigation, and tracking (PNT) system, will in the not too distant future be joined by the European Union's Galileo, a PNT system planned to be similar to GPS in function and performance. Will the two systems cooperate, providing users with the benefits of both, or will they compete? The authors assess the economic impact of competition and how the USA can address that competition, especially as it affects U.S. economic interests.

DTIC

Global Positioning System; Navigation Satellites

20050203720 ManTech, Inc., USA

SUV Rollover Test

Chambers, William V.; 23rd Space Simulation Conference Proceedings; [2005]; 40 pp.; In English; See also 20050203713; Original contains color illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The National Highway Traffic Safety Administration (NHTSA) approached NASA to evaluate vehicle rollover resistance using the High Capacity Centrifuge Facility. Testing was planned for six different sport utility vehicles. Previous methods for simulating the rollover conditions were considered to be not indicative of the true driving conditions. A more realistic gradual application of side loading could be achieved by using a centrifuge facility. A unique load measuring lower support system was designed to measure tire loading on the inboard tires and to indicate tire liftoff. This lower support system was designed to more closely emulate the actual rollover conditions. Additional design features were provided to mitigate potential safety hazards.

Author

Motor Vehicles; Roll; Lateral Stability; Centrifuges

20050203894 Warsaw Univ. of Technology, Warsaw, Poland

Simulation Supported Optimization of Container Storage Place

Amborski, Krzysztof; Conference on Advances in Internet Technologies and Applications, with Special Emphasis on E-Education, E-Enterprise, E-Manufacturing, E-Mobility, and Related Issues (CAITA-2004); [2004]; 7 pp.; In English; See also 20050203892; Copyright; Avail: CASI; [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The numerical optimization of all activities taking place in a container terminal enables among others a proper design of routes for the terminal vehicles transporting containers to and from a storage place and performing loading operations on it. The storage place in a container terminal is used to store containers, which cannot be taken out within a short time. Because the storage place is one of the parts of the terminal, its simulation should work in a system describing the whole terminal. For the simulation of the storage place there are two crucial points: the synchronization of events 1) the optimization of vehicles movements. 2) Because some events can occur simultaneously, it is indispensable to introduce priorities in their management. Therefore the highest priority has been attached to the truck service (i.e. loading containers on trucks), and the lowest priority to the transport of containers inside the storage place. Optimization procedures ensure the full dynamic evidence of containers being on the terminal and enable the best use of the terminal vehicles. In this paper two quality indices are taken into account first minimizing energy, second minimizing time of the service. The first index is deciding when there is reserve in time and therefore the costs of loading are prevailing. The second index when the terminal is almost full of containers waiting for immediate service.

Author

Loading Operations; Simulation; Containers; Storage

88

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20050199454 National Center for Microgravity Research on Fluids and Combustion, Cleveland, OH, USA, NASA Glenn Research Center, Cleveland, OH, USA

Physics of Colloids in Space (PCS) Flight Hardware Developed

Koudelka, John M.; Research and Technology 2000; March 2001; 3 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

investigation that will be located in an Expedite the Process of Experiments to Space Station (EXPRESS) Rack. The investigation will be conducted in the International Space Station U.S. laboratory, Destiny, over a period of approximately 10 months during the station assembly period from flight 6A through flight UF-2. This experiment will gather data on the basic physical properties of colloids by studying three different colloid systems with the objective of understanding how they grow and what structures they form. A colloidal suspension consists of fine particles (micrometer to submicrometer) suspended in a fluid for example, paints, milk, salad dressings, and aerosols. The long-term goal of this investigation is to learn how to steer the growth of colloidal suspensions to create new materials and new structures. This experiment is part of a two-stage

investigation conceived by Professor David Weitz of Harvard University along with Professor Peter Pusey of the University of Edinburgh. The experiment hardware was developed by the NASA Glenn Research Center through contracts with Dynacs, Inc., and ZIN Technologies.

Derived from text

Colloids; Spaceborne Experiments; Physical Properties

20050199587 NASA, Washington, DC, USA

Project Apollo: The Tough Decisions

Seamans, Robert C., Jr.; 2005; 160 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/SP-2005-4537; LC-2005003682; No Copyright; Avail: CASI; [A08](#), Hardcopy

The report reviews the major Mercury and then Gemini precursors for the Apollo mission program and its development and mission sequence. But, very importantly, it describes the major and often complex deliberations that encouraged inputs from the broad range of informed internal Agency individuals in order to arrive at the resulting actions taken; it recognizes differences among their various views, including even sensitivities within the leadership of the Agency, and it acknowledges NASA's relationships with the President and key executive branch personnel, as well as the very important and often complex relationships with members of Congress. The process of writing this book was searching and comprehensive. The achievement of the world's first manned lunar landings, after the earlier Mercury and Gemini programs played catch-up to match the Soviet Union's advanced position, clearly established the USA's preeminence in space. Early in the book, Bob describes an extended meeting in the White House in which the President's views and those of Mr. Webb were seriously discussed. Bob tells how, through Apollo's lunar landing, NASA clearly met both President Kennedy's goal to overcome the Soviets' leadership image and James Webb's goal to use Apollo as a major part of his program to demonstrate U.S. technological preeminence.

Derived from text

Lunar Landing; Apollo Flights; Leadership

20050201698 Natural Resources Canada, Ottawa, Ontario, Canada

Algonquin Radio Observatory

Searle, Anthony; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 45-47; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Algonquin Radio Observatory (ARO) is situated in Algonquin provincial park, about 250 km north of Ottawa and is operated by the Geodetic Survey Division (GSD) of the Natural Resources Canada in partnership with the Space Geodynamics Laboratory. The antenna is involved in a large number of international geodetic VLBI sessions each year and is a key site in the ongoing Canadian S2 developments. The ARO is the most sensitive IVS Network Station. This report summarizes recent activities at the Algonquin Radio Observatory.

Author

Very Long Base Interferometry; Antennas; Observatories; Space Laboratories; Geodesy

20050201701 Norwegian Mapping Authority, Honefoss, Norway

NYAL Ny-Alesund 20 Metre Antenna

Tangen, Leif Morten; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 88-89; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Geodetic Observatory of the Norwegian Mapping Authority at 78.9 N and 11.87 W is located in Ny-Alesund, in Kings Bay at the west side of the island of Spitsbergen, the biggest island in the Svalbard archipelago. In 2004, Ny-Alesund was scheduled for 80 VLBI experiments with R4, R1, EURO, VLBA/RDV, RD, T2 and ICRF. After mid June there was only one person at the station and all experiments with tape or more than two modules in Mark 5 have been cancelled. 70 experiments were run during the year. In addition to the 20-meter VLBI antenna, the observatory has two GPS antennas in the IGS system and a Super Conducting Gravimeter is installed on the site. On the site, there is also a CHAMP GPS and a PRARE installation. There is also a SATREF (dGPS) installation at the station.

Author

Observatories; Antennas; Very Long Base Interferometry; Global Positioning System; Very Long Baseline Array (VLBA)

20050201702 Telespazio S.p.A., Rome, Italy

Matra CGS VLBI Station

Colucci, Guisepe; Del Rosso, Domenico; Garramone, Luciano; International VLBI Service for Geodesy and Astrometry 2004

Annual Report; March 31, 2005, pp. 76-79; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report describes the status of the Matera VLBI station, after the major hardware failure happened at the beginning of 2004. Also an overview of the station, some technical characteristics of the system and staff addresses will be given.

Author

Very Long Base Interferometry; Failure; Observatories

20050201703 Onsala Space Observatory, Sweden

The IVS Network Station Onsala Space Observatory

Haas, Rudiger; Elgered, Gunnar; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 93-96; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

Descriptions of the IVS Network Station at the Onsala Space Observatory (OSO) have been included in previous IVS annual reports. In 2004 we started to use the 1 Gbps fiber link connection for eVLBI tests. The first ever intercontinental real-time VLBI fringes were obtained on the base-line Onsala-Westford. We organized a first NORDIC experiment including the available stations in Fennoscandia. Unfortunately, no fringes on baselines with Onsala were found in this experiment. One of the two masers at the observatory failed and was taken out of the operation. Throughout the year 2004 we still experienced problems with the amplifiers of the telescopes azimuth encoders. In late November the cooling system of the S/X receiver failed and thus the last three experiments in 2004 had to be observed with a warm receiver.

Derived from text

Observatories; Very Long Base Interferometry; Real Time Operation

20050201715 Bundesamt fuer Kartographie und Geodaesie, Wettzell, Germany

Fundamentalstation Wettzell - 20m Radiotelescope

Kilger, Richard; Kronschnabl, Gerhard; Schluter, Wolfgang; Zerneck, Rudolf; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 125-128; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

In 2004 the 20-m Radiotelescope Wettzell contributed strongly to the IVS observing program. The transition to the Mark 5A system has been completed and the system is used for routine operation. A 34Mbps Internet link has been installed. In particular the intensive observations were the candidates for e-VLBI activities. Technical changes, improvements and upgrades have been done to increase the reliability of the entire system.

Author

Radio Telescopes; Very Long Base Interferometry; Internets; Observatories

20050201726 Onsala Space Observatory, Sweden

The IVS Technology Development Center at Onsala Space Observatory

Nilsson, Tobias; Elgered, Gunnar; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 276-279; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The main development activity in 2004 was to investigate the stability of the Astrid Water Vapor Radiometer (WVR) at the Onsala Space Observatory in terms of its instrumental noise. We have investigated algorithms based on a model for the correlations between slant wet delays in different directions. Using these algorithms it is possible to estimate how much of the variability in the measured slant wet delays was due to the atmospheric variability and how much was due to instrumental noise.

Author

Observatories; Radiometers; Correlation; Water Vapor

20050201731 Instituto Geografico Nacional, Madrid, Spain

Observatorio Astronomico Nacional - Yebes

Colomer, Francisco; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 129-132; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report updates the description and details of the OAN facilities as a IVS network station. The construction of the new 40-meter radiotelescope has progressed substantially, after the main parabolic reflector and subreflector have been lifted on

top of the concrete tower. Completed construction in 2005 will allow the installation of a new S/X band receiver, in order to restart the geodetic VLBI observations in 2006. The institute staff is also involved in technical developments, scientific research in geodesy, astrometry and astrophysics.

Author

Very Long Base Interferometry; Radio Telescopes; Geodetic Surveys; Radio Receivers; Parabolic Reflectors; Superhigh Frequencies

20050201732 Geographical Survey Inst., Japan

Tsukuba 32-m VLBI Station

Fujisaku, Junichi; Kurihara, Shinobu; Takashima, Kazuhiro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 115-118; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the observation activities at the Tsukuba 32-m VLBI station by the Geographical Survey Institute (GSI) VLBI Group. In 2004, the station had 36 international, 12 domestic and 60 intensive UT1 sessions. Some of these experiments, such as IVS-R&D and several UV1 sessions, were carried out using disk-based K-5 sampling/recording system with internet data transfer. We plan to use this system for most of our sessions in 2005.

Author

Very Long Base Interferometry; Antennas; Sampling; Geological Surveys

20050201758 Shanghai Astronomical Observatory, China

Shanghai Astronomical Observatory Analysis Center 2004 Annual Report

Li, Jinling; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 243-246; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Research activities mainly focused on satellite positioning and orbit determination by VLBI. Other activities included the coordination of VLBI experiments, data archives, reduction and application studies. Further plans are to contribute to IVS the quarterly solutions of the Earth Orientation Parameters.

Author

Astronomical Observatories; Very Long Base Interferometry; Satellite Orbits; Orbit Determination; Data Reduction

20050201759 Technische Univ., Munich, Germany

Combination Studies using the CONT02 Campaign

Thaller, Daniela; Kruegel, Manuela; Angermann, Detlef; Rothacher, Markus; Schmid, Ralf; Tesmer, Volker; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 13-21; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

This report gives an overview of the combination studies performed by the Forschungseinrichtung Satellitengeodäsie TU München (FESG) and the Deutsches Geodätisches Forschungsinstitut (DGFI) based on the data of the IVS CONT02 campaign. The presented results demonstrate the high potential of a combination of VLBI, GPS and SLR data.

Author

Global Positioning System; Very Long Base Interferometry; Geodesy; Astrometry

20050201763 Natural Resources Canada, Ottawa, Ontario, Canada

Yellowknife Observatory

Berube, Mario; Searle, Anthony; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 133-134; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Yellowknife VLBI antenna is a 9m diameter antenna which was formerly the 'MV-1' mobile antenna. The MV-1 was a proof-of-concept for mobile VLBI and in 1991 NASA and NOAA offered the system for use at Yellowknife. The antenna is located at the Yellowknife Geophysical Observatory and is operated by the Geodetic Survey Division, Natural Resources Canada. This report gives an update on recent activities.

Author

Very Long Base Interferometry; Geophysical Observatories; Geodetic Surveys; Antennas

20050201765 Naval Observatory, USA

Washington Correlator

Kingham, Kerry A.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 166-168; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of the Washington Correlator for the year 2004. The Washington Correlator provides up to 136 hours of processing per week, primarily supporting Earth Orientation and astrometric observations. In 2004 the major programs supported include the IVS-R4, IVS-INT, IRS-R1, IVS-T and CRF and CRFD experiments. Two Mark 5 playbacks were added bringing the total at the correlator to 8.

Author

Astrometry; Correlators; Earth Orientation; Playbacks

20050201769 Naval Observatory, Washington, DC, USA

U.S. Naval Observatory VLBI Analysis Center

Boboltz, David A.; Fey, Alan L.; Hall, David M.; Kingham, Kerry A.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 247-250; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes activities of the VLBI Analysis Center at the U.S. Naval Observatory for 2004. Biweekly diurnal experiments with designations IVS-R1 and IVS-R4 for use in-house were analyzed. The Analysis Center produced two periodic global Terrestrial Reference Frame (TRF) solutions with designations usn2004a and usn 2004b. New activities included the generation of daily solution files in the SINEX format based on the 24-hr experiments from January 1996 to present.

Author

Very Long Base Interferometry; Observatories; Diurnal Variations; Coordinates

20050202030 Iowa State Univ. of Science and Technology, Ames, IA, USA

Influence of Hydroponically Grown Hoyt Soybeans and Radiation Encountered on Mars Missions on the Yield and Quality of Soymilk and Tofu

Wilson, Lester A.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 22-1 - 22-14; In English; See also 20050202011; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; [A03](#), Hardcopy

Soybeans were chosen for hmar and planetary missions due to their nutritive value and ability to produce oil and protein for further food applications. However, soybeans must be processed into foods prior to crew consumption. Wilson et al. (2003) raised questions about (1) the influence of radiation (on germination and functional properties) that the soybeans would be exposed to during bulk storage for a Mars mission, and (2) the impact of using hydroponically grown versus field grown soybeans on the yield and quality of soyfoods. The influence of radiation can be broken down into two components: (A) affect of surface pasteurization to ensure the astronauts safety from food-borne illnesses (a Hazard Analysis Critical Control Point), and (B) affect of the amount of radiation the soybeans receive during a Mars mission. Decreases in the amount of natural antioxidants and free radical formation and oxidation induced changes in the soybean (lipid, protein, etc.) will influence the nutritional value, texture, quality, and safety of soyfoods made from them. The objectives of this project are to (1) evaluate the influence of gamma and electron beam radiation on bulk soybeans (HACCP, CCP) on the microbial load, germination, ease of processing, and quality of soymilk and tofu; (2) provide scale up and mass balance data for Advanced Life Support subsystems including Biomass, Solid Waste Processing, and Water Recovery Systems; and (3) to compare Hoyt field grown to hydroponically grown Hoyt soybeans for soymilk and tofu production. The soybean cultivar Hoyt, a small standing, high protein cultivar that could grow hydroponically in the AIMS facility on Mars) was evaluated for the production of soymilk and tofu. The quality and yield of the soymilk and tofu from hydroponic Hoyt, was compared to Vinton 81 (a soyfood industry standard), field Hoyt, IA 2032LS (lipoxygenase-free), and Proto (high protein and antioxidant potential). Soymilk and tofu were produced using the Japanese method. The soymilk was coagulated with calcium sulfate dihydrate. Soybeans and tofu were evaluated using chemical, microbial, and instrumental sensory methods. The surface radiation of whole dry soybeans using electron beam or gamma rays at 10 or 30 kGy did provide microbial safety for the astronauts. However, these doses caused oxidative changes that resulted in tofu with rancid aroma, darkening of the tofu, lower tofu yields, more solid waste, and loss of the ability of the seeds to germinate. While lower doses may reduce these problems, we lose the ability to insure microbial safety (cross-contamination) of bulk soybeans for the astronauts. Counter measures could include vacuum packaging, radiating under freezing conditions. A No Effect Dose for food quality, below 10 kGy needs to be determined.

Better estimates of the radiation that the food will be exposed to need to be determined and shared. Appropriate shielding for the food as well as the astronauts needs to be developed. The Hoyt soybean did not provide a high yielding, high quality tofu. A new small scale system for evaluating soybeans was developed using 50 g quantities of soybeans.

Author

Electron Beams; Gamma Rays; Soybeans; Water Reclamation; Solid Wastes; Life Support Systems; Hydroponics

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20050199473 National Optical Astronomy Observatories, Tucson, AZ, USA, National Solar Observatory, Tucson, AZ, USA
NOAO/NSO Newsletter, No. 82

Isabell, Douglas, Editor; Najita, Joan, Editor; Bell, Dave, Editor; Hartman, Mia, Editor; vanderBlik, Nicole S.; Green, Richard; Hinkle, Ken; Adams, Sally; Leibacher, John, Editor; Piano, Priscilla, Editor, et al.; June 2005; 46 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail: Other Sources

This issue is divided into sections, which each contain several articles on the operations of the National Optical Astronomy Observatory/National Solar Observatory (NOAO/NSO). The sections are: 1) Science Highlights; 2) Director's Office; 3) NOAO Gemini Science Center; 4) Observational Programs; 5) Cerro Tololo Inter-American Observatory; 6) Kitt Peak National Observatory; 7) National Solar Observatory/GONG; 8) Public Affairs and Educational Outreach.

CASI

Astronomical Observatories; Solar Observatories; Space Observations (From Earth)

20050199475 NASA Marshall Space Flight Center, Huntsville, AL, USA

A General Relativistic Magnetohydrodynamic Simulation of Jet Formation

Nishikawa, K.-I.; Richardson, G.; Koide, S.; Shibata, K.; Kudoh, T.; Hardee, P.; Fishman, G. J.; The Astrophysical Journal; May 20, 2005; Volume 625, pp. 60-71; In English; Original contains color illustrations
Contract(s)/Grant(s): NSF ATM-97-30230; NSF ATM-98-70072; NSF ATM-01-00997; NSF INT-99-81508; Copyright; Avail: Other Sources

We have performed a fully three-dimensional general relativistic magnetohydrodynamic (GRMHD) simulation of jet formation from a thin accretion disk around a Schwarzschild black hole with a free-falling corona. The initial simulation results show that a bipolar jet (velocity approx. $0.3c$) is created, as shown by previous two-dimensional axisymmetric simulations with mirror symmetry at the equator. The three-dimensional simulation ran over 100 light crossing time units ($T_{\text{sub } s} = r_{\text{sub } s}/c$, where $r_{\text{sub } s} = 2GM/c^2$), which is considerably longer than the previous simulations. We show that the jet is initially formed as predicted owing in part to magnetic pressure from the twisting of the initially uniform magnetic field and from gas pressure associated with shock formation in the region around $r = 3r_{\text{sub } s}$. At later times, the accretion disk becomes thick and the jet fades resulting in a wind that is ejected from the surface of the thickened (torus-like) disk. It should be noted that no streaming matter from a donor is included at the outer boundary in the simulation (an isolated black hole not binary black hole). The wind flows outward with a wider angle than the initial jet. The widening of the jet is consistent with the outward-moving torsional Alfvén waves. This evolution of disk-jet coupling suggests that the jet fades with a thickened accretion disk because of the lack of streaming material from an accompanying star.

Author

Accretion Disks; Black Holes (Astronomy); Magnetohydrodynamics; Magnetic Fields; Active Galaxies; Coronas; Bipolarity

20050199479 Massachusetts Inst. of Tech., Cambridge, MA, USA

An Integral Study of Galactic Black Hole States

[2005]; 1 pp.; In English

Contract(s)/Grant(s): NAG5-13283

Report No.(s): MIT-6894744; No Copyright; Avail: CASI; [A01](#), Hardcopy

XTE 51550-564 was clearly detected with INTEGRAL out to 600 keV with the SPI, and is one of only two sources detected with IBIS/ISIT. Software difficulties in analyzing the data prevented us from progressing with the analysis past the most elementary stages (see last year's report). The support from the INTEGRAL help desk has been very disappointing. People affiliated with INTEGRAL published a paper on the results of our data before we could master the reduction and

analysis software. We are not the only group that got stuck with the analysis without adequate support from the INTEGRAL help desk. This was a rather disappointing experience as we lost many months of valuable time and efforts.

Author

Black Holes (Astronomy); Galaxies

20050199480 Naval Observatory, Washington, DC, USA

Perturbations of the Five Outer Planets by the Four Inner Ones

Clemence, G. M.; *Astronomical Papers*; 1954; Volume 13, Pt. 5, pp. 367-406; In English; No Copyright; Avail: CASI; [A03](#), Hardcopy

In Volume XII of these Papers are printed the equatorial rectangular heliocentric coordinates of the five outer planets from 1653 to 2060 at intervals of 40 days. The coordinates were obtained by step-by-step numerical integration in which the mutual actions of the five outer planets, and of the Sun with each of them, were rigorously calculated at every step; so far as these six bodies are concerned, no portion of the disturbing forces was neglected. But the action of the four inner planets was taken into account only partially; all that was done was to add their masses to that of the Sun. For most of the applications that the data in Volume XII were intended for, they are fully adequate as they stand, but for the calculation of geocentric ephemerides it is desirable that the perturbations by the inner planets should be included; ephemerides intended for precise comparison with observations should be formally somewhat more accurate than the observations themselves. In the present work are developed general expressions for the perturbations of the five outer planets by the four inner ones, with sufficient precision to serve for all practical purposes for at least five centuries before and after our time. Tables placed at the end permit the ready evaluation of the perturbations for any date.

Derived from text

Planet Ephemerides; Orbit Perturbation; Gas Giant Planets; Terrestrial Planets; Gravitational Effects; Astronomical Catalogs; Solar Orbits; Planetary Gravitation; Ephemerides; Perturbation

20050199494 Nautical Almanac Office, Washington, DC, USA

New Elements of Mars and Tables for Correcting the Heliocentric Positions Derived from Astronomical Papers, Vol. VI, Part IV

Ross, Frank E.; *Astronomical Papers*; 1917; Volume 9, Part 2, pp. 251-274; In English; No Copyright; Avail: CASI; [A03](#), Hardcopy

Late in 1912, at the suggestion of Dr. F. E. Ross, of the Nautical Almanac Office, there was assigned to him by the Director of the Office, Professor W.S. Eichelberger, U.S.N., the task of discovering the cause of the discordance between the positions of Mars deduced from observations and those computed from the tables in *Astronomical Papers*, Volume VI, Part IV, the discordance amounting to six seconds of arc in right ascension in 1905. The results of this investigation, bringing theory and observation into satisfactory agreement, are contained in the following pages. The entire work was done by Dr. Ross with such assistance from the Nautical Almanac force, in the computing, as he from time to time requested.

Author

Mars (Planet); Orbital Elements; Planet Ephemerides; Orbit Calculation

20050199673 Naval Observatory, Washington, DC, USA

Astronomical Papers: First-Order Theory of Mars, Volume XI, Part II

Clemence, G. M.; 1949; 277 pp.; In English; No Copyright; Avail: CASI; [A13](#), Hardcopy

The purpose of this paper is to determine the coefficients of all the inequalities in the motion of Mars with an accuracy such that, the necessary constants being assumed known, the geocentric position of the planet could be obtained with a precision of 0.01 arc sec for five centuries or more before and after the central epoch. This degree of precision demands that the coefficients of most of the periodic terms be accurate to about 0.0003 arc sec. The results here presented form a portion of this undertaking, and comprise all of the perturbations of Mars of the first order as to the masses; the perturbations of higher order remain to be calculated. The series for the fifth power of the reciprocals of the distances are given, however, although they are not needed for the perturbations of the first order; they are most easily calculated at the same time as the first and third powers. The method used is that of P.A. Hansen, as modified by G.W. Hill in his theory of Jupiter and Saturn. In addition to the well-known intrinsic advantages of the method there is the added advantage that it will be possible to use Hill's results for Jupiter and Saturn unchanged in calculating the relevant terms of the second order, avoiding an extensive series of transformations that would otherwise be necessary. The calculations have been almost exclusively performed with punched cards. The techniques employed have been specially chosen with a view to the detection of errors of calculation, and stringent

tests have been applied at every stage of the work. It is, naturally, impossible to say with absolute certainty that no numerical error is present, but it is believed that the likelihood of one is as small as it is practicable to make it - certainly much smaller than in any previous work of this kind.

Derived from text

Mars (Planet); Planet Ephemerides; Orbit Perturbation; Perturbation Theory; Orbit Calculation; Gravitational Effects; Planetary Gravitation

20050199700 Naval Observatory, Washington, DC, USA

Catalog of 5,268 Standard Stars, 1950.0 Based on the Normal System N30, Volume 13, Part 3

Morgan, H. R.; 1952; 239 pp.; In English; No Copyright; Avail: CASI; [A11](#), Hardcopy

The construction of the catalog of 5,268 standard stars, 1950.0, based on the normal system N30, was undertaken as a part of a project on the motions of the principal planets. The project as a whole, begun in April 1947, with the sponsorship of the Office of Naval Research, is still continuing as a cooperative enterprise of the USA Naval Observatory, the Yale University Observatory, and the Watson Scientific Computing Laboratory. The results of the revision of the fundamental star positions and proper motions obtained by the author of this catalog will add considerably to the value of the interpretation of planetary observations, especially those of the nineteenth century. This was the primary purpose that led to the formation of the catalog. As is apparent from the Introduction, the value of the work goes well beyond this application.

Derived from text

Astronomical Catalogs; Stars; Astrometry; Proper Motion

20050199702 Lick Observatory, Santa Cruz, CA, USA

The X-ray halo of an extremely luminous LSB disk galaxy

Weiner, Benjamin J.; [2004]; 2 pp.; In English

Contract(s)/Grant(s): NAG5-10053; No Copyright; Avail: CASI; [A01](#), Hardcopy

We are continuing to refine our upper limit on emission from halo gas in Malin 2. The upper limit is, of course, below the detected flux, but is made more difficult to quantify by the disk and possible AGN sources. We are also exploring spectral and spatial-size constraints to help separate the sources of emission. On the theory side, more recent work on the X-ray halo luminosity from halo gas leftover from galaxy formation has lowered the prediction for disk galaxies (e.g. Toft et al. 2002, MNRAS, 335, 799). While our upper limit is well below the original prediction, refinements in model have moved the theoretical goalposts, so that the observation may be consistent with newer models. A recent theoretical development, which our observations of Malin 2 appear to support, is that a substantial amount of mass can be accreted onto galaxies without being heated at a virial shock. The previous standard theory was that gas accreting into a halo hits a virial shock and is heated to high temperatures, which could produce X-ray halos in massive galaxies. Recent models show that 'smooth accretion' of matter bypasses the virial shocking (Murali et al. 2002, ApJ, 571, 1; Birnboim & Dekel 2003, MNRAS, 345, 349). Additionally, new hydrodynamical simulations of galaxy mergers by UCSC graduate student T. J. Cox show that hot gas halos can be created by gas blown out from the merger, taking up orbital energy of the merging galaxies (Cox et al. 2004, ApJ, 607, L87). If mergers rather than virial shocking are the origin of hot gas halos, the existence of an X-ray halo should depend more on past merger activity than halo mass. Then it makes sense that elliptical galaxies and poor groups with ellipticals, which are probably formed in mergers, have X-ray gas halos; while a giant, quiescent LSB disk galaxy like Malin 2, which has never suffered a major merger, does not have an X-ray halo. While both the observational expectations and theoretical models have changed since we began this project, which has forced us to re-evaluate the goals, we are pressing forward to firm up the observations and put them in context of the current models for X-ray halos of massive galaxies.

Derived from text

Disk Galaxies; Halos; Luminosity; High Temperature Gases; X Ray Sources; Astronomical Models

20050199759 Naval Observatory, Washington, DC, USA

The Mass of Saturn and the Motion of Jupiter 1884-1948, Volume 15, Part 2

Hertz, Hans G.; 1953; 47 pp.; In English; No Copyright; Avail: CASI; [A03](#), Hardcopy

The purpose of this investigation is the determination of the mass of Saturn from observations of Jupiter not utilized by G. W. Hill in the construction of his Tables of Jupiter. The Astronomer Royal and H. M. Astronomer at the Cape have kindly communicated unpublished observations made at Greenwich and the Cape of Good Hope respectively. Unpublished observations made at Washington have been kindly furnished by F.P. Scott and C.B. Watts. Coordinates of Jupiter for every

400 days from 1900 to 1960 have been kindly supplied by D.H. Sadler, Superintendent of H. M. Nautical Almanac Office.
Derived from text
Planetary Mass; Saturn (Planet); Planet Ephemerides

20050201052 Academia Sinica, Shanghai, China

A New Nutation Model of Nonrigid Earth With Ocean and Atmosphere

Huang, Cheng-li; Jin, Wen-jing; Liao, Xing-hao; Mar. 2000; 7 pp.; In English
Report No.(s): AD-A435806; No Copyright; Avail: CASI; [A02](#), Hardcopy

By integrating the truncated complex scalar gravitational motion equations for an anelastic, rotating, slightly elliptical Earth, the complex frequency dependent Earth transfer functions are computed directly. Unlike the conventional method, the effects of both oceanic loads and tidal currents are included via outer surface boundary conditions, all of which are expanded to second order in ellipticity. A modified ellipticity profile in second order accuracy for the non-hydrostatic Earth is obtained from Clairaut's equation and the PREM Earth model by adjusting both the ellipticity of the core-mantle boundary and the global dynamical ellipticity to modern observations. The effects of different Earth models, anelastic models, and ocean models are computed and compared. The atmospheric contributions to prograde annual, retrograde annual and retrograde semiannual nutation are also included as oceanic effects. Finally, a complete new nutation series of more than 340 periods, including in-phase and out-of-phase parts of longitude and obliquity terms, for a more realistic Earth, is obtained and compared with other available nutation series and observations.

DTIC

Air Water Interactions; Nutation; Ocean Models

20050201697 NASA Goddard Space Flight Center, Greenbelt, MD, USA

International VLBI Service for Geodesy and Astrometry 2004 Annual Report

Behrend, Dirk, Editor; Baver, Karen D., Editor; March 31, 2005; 323 pp.; In English; See also 20050201698 - 20050201769
Report No.(s): NASA/TP-2005-212772; Rept-2005-00586-2; No Copyright; Avail: CASI; [A14](#), Hardcopy

Contents include the following: Combination Studies using the Cont02 Campaign. Coordinating Center report. Analysis coordinator report. Network coordinator report. IVS Technology coordinator report. Algonquin Radio observatory. Fortaleza Station report for 2004. Gilmore Creek Geophysical Observatory. Goddard Geophysical and Astronomical observatory. Hartebeesthoek Radio Astronomy Observatory (HartRAO). Hbart, Mt Pleasant, station report for 2004. Kashima 34m Radio Telescope. Kashima and Koganei 11-m VLBI Stations. Kokee Park Geophysical Observatory. Matera GGS VLBI Station. The Medicina Station status report. Report of the Mizusawa 10m Telescope. Noto Station Activity. NYAL Ny-Alesund 20 metre Antenna. German Antarctic receiving Station (GARS) O'higgins. The IVS network station Onsala space Observatory. Sheshan VLBI Station report for 2004. 10 Years of Geodetic Experiments at the Simeiz VLBI Station. Svetloe Radio Astronomical Observatory. JARE Syowa Station 11-m Antenna, Antarctica. Geodetic Observatory TIGO in Concepcion. Tsukuba 32-m VLBI Station. Nanshan VLBI Station Report. Westford Antenna. Fundamental-station Wettzell 20m Radiotelescope. Observatorio Astroonomico Nacional Yebes. Yellowknife Observatory. The Bonn Geodetic VLBI Operation Center. CORE Operation Center Report. U.S. Naval Observatory Operation Center. The Bonn Astro/Geo Mark IV Correlator.

CASI

Astronomical Observatories; Geodesy; Radio Astronomy; Very Long Base Interferometry

20050201699 Centro de Radio Astronomia e Aplicacoes Espaciais, Sao Paulo, Brazil

Fortaleza Station Report for 2004

Kaufmann, Pierre; PereiradeLucena, A. Macilio; SombradaSilva, Adeildo; Tateyama, Claudio E.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 48-50; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This is a brief report on the activities carried on at Fortaleza geodetic-VLBI Station (ROEN: Radio Observatorio Espacial do Nordeste_, located in Eusebio, CE, Brazil in 2004. Observing activities consisted of 73 VLBI sessions and continuous GPS monitoring recordings. Further results were obtained on the dynamics of quasar spatial structures. A new contract was signed between NASA and CRAAM, Mackenzie Presbyterian Institute and University to partially support the activities at ROEN until 2009. The contract was made under the auspices of an Agreement of Cooperation between NASA-representing research interests of NOAA and USNO-and the Brazilian Space Agency AEB.

Author

Very Long Base Interferometry; Observatories; Global Positioning System; Quasars

20050201700 National Inst. of Information and Communications Technology, Tokyo, Japan

Kashima 3-4m Radio Telescope

Kawai, Eiji; Takeuchi, Hiroshi; Kuboki, Hiromitsu; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 64-67; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Communications Research Laboratory (CRL) was reorganized into National Institute of Information and Communications Technology (NICT) in April, 2004. NICT will operate Kashima 34-m radio telescope continuously as a facility of the Kashima Space Research Center. This is the network station report mainly focused on the telescope facilities.

Author

Information Systems; Radio Telescopes

20050201704 Shanghai Astronomical Observatory, China

Sheshan VLBI Station Report for 2004

Hong, Xiaoyu; Wei, Wenren; Liang, Shiguang; Huang, Xinyong; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 97-99; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Sheshan (also called Seshan) 25-meter radio telescope is an alt-az antenna run by Shanghai Astronomical Observatory (SHAO), Chinese Academy of Sciences (CAS). It is one of the six main astronomical facilities of Chinese National Astronomical Observatories. The VLBI station is a member of the EVN, IVS, and APT. We give a short report about the current status and future plans of Sheshan VLBI station of Shanghai Astronomical Observatory as an IVS Network station.

Author

Astronomical Observatories; China; Radio Telescopes; Radio Astronomy; Very Long Base Interferometry; Ground Stations

20050201710 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

JPL VLBI Analysis Center IVS Annual Report for 2004

Jacobs, Chris; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 225-228; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report describes the activities of the JPL VLBI analysis center for the year 2004. We continue to be celestial reference frame, terrestrial reference frame, earth orientation, and spacecraft navigation work using the VLBI technique. There are several areas of our work that are undergoing active development. In 2004 we demonstrated 1 mm level troposphere calibration on an intercontinental baseline. We detected our first X/Ka (8.4/32 GHz) VLBI fringes. We began to deploy Mark 5 recorders and to interface the Mark 5 units to our software correlator. We also have actively participated in the international VLBI community through our involvement in six papers at the February IVS meeting and by collaborating on a number of projects such as densifying the S/X celestial frame creating celestial frames at K (24 GHz) and Q-bands (\$# GHz)\g

Author

Celestial Reference Systems; Densification; Earth Orientation; Space Navigation; Very Long Base Interferometry

20050201711 Natural Resources Canada, Ottawa, Ontario, Canada

Canadian VLBI Technology Development Center

Searle, Anthony; Petrachenko, Bill; Berube, Mario; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 257-258; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The Canadian Technology Development Center has developed an 'end-to end' geodetic VLBI system build on S2 equipment. The development of this system has led to an operational IVS network. Development work continues to streamline operations and improve S2 instrumentation.

Author

Astronomical Observatories; Very Long Base Interferometry

20050201714 Bonn Univ., Germany

The Bonn Geodetic VLBI Operation Center

Nothnagel, Axel; Mueskens, Arno; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 137-138; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

In 2004 the GUIB Operation Center has continued to carry out similar tasks of organizing and scheduling various observing series as in 2003.

Author

Very Long Base Interferometry; Scheduling; Geodesy

20050201718 Bordeaux 2 Univ., France

Bordeaux Observatory Analysis Center Report

Charlot, Patrick; Bellanger, Antoine; Baudry, Alain; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 192-195; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of the Bordeaux Observatory Analysis Center during the year 2004. On the analysis side, we have completed processing of six years of NEOS-A/IVS-R4 data (1999-2004) and two years of IVS-R1 data (2003-2004). On the research side, our major achievements include initial analysis of the three experiments conducted as part of our ICRF densification project in the northern sky, evaluation of astrometric suitability for an additional 96 ICRF sources at X band - all of which are in the southern sky- and another 122 sources at K band. Plans for 2005 follow the same analysis and research lines.

Author

Astrometry; Superhigh Frequencies; Densification; Observatories

20050201719 Geoscience Australia, Bruce, Australia

Geoscience Australia Analysis Center

Titov, Oleg; Govind, Ramesh; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 189-191; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report gives an overview about the activities of the Geoscience Australia IVS Analysis Center during the 2004 year.

Author

Geophysics; Astronomical Observatories

20050201720 Saint Petersburg Univ., Saint Petersburg, Russia

Analysis Center of Saint Petersburg University

Kudryashova, Maria; Vityazev, Veniamin; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 187-188; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The contribution of the Analysis Center of Saint Petersburg University for IVS in the year 2004 consists in routine estimations of EOP time series and UT1-UTC values. Information about activity, staff members and background information is included in this report.

Author

Russian Federation; University Program; Data Processing; Research Facilities; Very Long Base Interferometry

20050201721 Massachusetts Inst. of Tech., MA, USA

MIT Haystack Observatory Analysis Center

Niell, Arthur; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 213-214; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The primary contribution of Haystack Observatory to analysis of geodetic VLBI data is improvement of accuracy in the estimation of atmospheric delay. In the past year investigation was begun of the possible contribution of high horizontal resolution Numerical Weather Models to better understand the delay due to small-scale structure of water vapor.

Author

Atmospheric Models; Very Long Base Interferometry; Numerical Weather Forecasting; Accuracy; Observatories

20050201722 Academy of Sciences (Russia), Saint Petersburg, Russia

IAA VLBI Analysis Center Report 2004

Malkin, Zinovy; Skurikhina, Elena; Melnikov, Alexey; Gubanov, Vadim; Kurdubov, Sergey; Surkis, Igor; Krasinsky, George; Sokolova, Julia; Shuygina, Nadia; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 215-218; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The report contains a brief overview of IAA VLBI analysis activities in 2004 and the plans for the coming year.

Author

Very Long Base Interferometry; Astronomical Observatories

20050201733 Universidad de Concepcion, Chile

Geodetic Observatory TIGO in Concepcion

Boer, Armin; Riepl, Stefan; Sobarzo, Sergio; Jara, Cristobal; Aedo, Roberto; Remedi, Gonzalo; Moreno, Marcus; Hermosilla, Gonzalo; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005; 4 pp.; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

During TIGO's third year of operation in Concepcion, TIGO performed 96 24th VLBI-observations and is hence one of the most scheduled IVS-sites. The radiotelescope got a new antenna control unit. TIGO supported the operation at O'Higgins. Activities of the VLBI-group at TIGO during 2004 and an outlook for 2005 are given.

Author

Geodesy; Observatories; Very Long Base Interferometry

20050201736 Bundesamt fuer Kartographie und Geodaesie, Germany

The BKG/GIUB VLBI Analysis Center

Thorandt, Volkmar; Nothnagel, Axel; Engelhardt, Gerald; Vennebusch, Markus; Fischer, Dorothee; Ullrich, Dieter; Steinforth, Christoph; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 205-208; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The activities at the BKG/GIUB VLBI Analysis Center for the year 2004 consist of routine computations of Earth orientation parameters (EOP) time series and a number of research topics in geodetic VLBI. In 2004 the VLBI group at BKG started regular submission of time series of tropospheric parameters for all 24 hours VLBI session from 1984 onward. The generation of daily SINEX (Solution INdependent EXchange form) files was continued for all available 24 hours sessions. Quarterly updated solutions were computed for the IVS products Terrestrial Reference Frame (TRF) and Celestial Reference Frame (CRF). The UT1 Intensive series was expended by the processing of the baseline observations Tsukuba-Wettzell. At BKG also investigations related to the reliability of antenna axis offsets and radio source stability were made. At GUIB the emphasis was placed on individual research topics.

Author

Earth Orientation; Geodesy; Time Series Analysis; Troposphere

20050201738 Astronomical Observatory, China

Nanshan VLBI Station Report

Liu, Xiang; Chen, Maozheng; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 119-120; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

We briefly report the activities and status of Nanshan VLBI station in 2004. The VLBI back-end has been upgraded to Mark 5A, and the Team China visited the station in May.

Author

Very Long Base Interferometry; Astronomical Observatories

20050201740 Norwegian Defence Research Establishment, Norway

FFI Analysis Center

Andersen, Per Helge; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 203-204; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

FFI's contribution to the IVS as an analysis center will focus primarily on a combined analysis at the observation level of data from VLBI, GPS and SLR using the GEOSAT software. FFI is currently Analysis Center for IVS and ILRS, Technology Development Center for IVS, and Combination Research Center for IERS.

Author

Global Positioning System; Astronomical Observatories

20050201741 Telespazio S.p.A., Rome, Italy

Matera CGS VLBI Analysis Center

Lanotte, Roberto; Mauro Pirri; Bianco, Giuseppe; Sciaretta, Cecilia; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 196-198; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

The paper reports the VLBI data analysis activities at the Space Geodesy Center CGS at Matera from January 2004 through December 2004 and the contributions that the CGS intends to provide for the future as an IVS Data Analysis Center.

Author

Very Long Base Interferometry; Astronomical Observatories

20050201742 Consiglio Nazionale delle Ricerche, Bologna, Italy

Italy CNR Analysis Center Report

Negusini, M.; Sarti, P.; Montaguti, S.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 219-220; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activity of the Italy CNR VLBI Analysis Center. We also report about some major changes that occurred during 2004. The institute changed its affiliation and location (officially taking effect on 1st January 2005). Modification of names and codes necessary for the IVS affiliation will be requested and performed during 2005. A new contract person for the IVS AC will be indicated. The structure and the activities of the Analysis Center remain unchanged.

Author

Italy; Very Long Base Interferometry; Data Processing; Ground Stations; Radio Astronomy; Geodesy

20050201743 NVI, Inc., Greenbelt, MD, USA

Coordinating Center Report

Vandenberg, Nancy R.; Behrend, Dirk; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 25-27; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of the IVS Coordinating Center during the year 2004, and forecasting activities planning for the year 2005.

Author

Astronomical Observatories; Very Long Base Interferometry

20050201746 Honeywell Technology Solutions, Inc., USA

Kokee Park Geophysical Observatory

Cox, Clyde A.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 72-75; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the technical parameters and the technical staff of the VLBI system at Kokee Park on the Island of Kauai. Included is an overview of the VLBI activities for the year 2004.

Author

Geophysical Observatories; Geophysics

20050201747 National Astronomical Observatory, Iwate, Japan

Report of the Mizusawa 10m Telescope

Manabe, Seiji; Kameya, Osamu; Iwade, Kenzaburo; Jike, Takaaki; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 83-85; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The status and activities of the Mizusawa 10m VLBI telescope are reported.

Author

Very Long Base Interferometry; Radio Telescopes; Radio Astronomy; Japan

20050201748 Consiglio Nazionale delle Ricerche, Italy

Noto Station Activity

Tuccari, G.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 86-87; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

The most important achievements at the Noto station are presented and a general status is described about developments and future plans. In particular the progress related to the DBBC development, a digital base band converter system, is reported in some detail.

Author

Very Long Base Interferometry; Astronomical Observatories

20050201749 Main Astronomical Observatory, Kiev, Ukraine

IVS Analysis Center at Main Astronomical Observatory of National Academy of Sciences of Ukraine

Bolotin, Sergei; Yatskiv, Yaroslav; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 229-230; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the activities of VLBI Analysis Center at Main Astronomical Observatory of National Academy of Sciences of Ukraine in 2004.

Author

Astronomical Observatories; Ukraine; Very Long Base Interferometry; Data Processing

20050201752 Academy of Sciences (Russia), Saint Petersburg, Russia

Svetloe Radio Astronomical Observatory

Smolentsev, Sergey; Rachimov, Ismail; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 104-106; In English; See also 20050201697; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report provides information about changes in the Svetloe Radio Astronomy Observatory (SvRAO) status in period spanning after the last IVS report. The activities during 2004, the current status, and future plans are described. During 2004 a number of maintenance and upgrade activities were performed at SvRAO. Mark 5A and S2-DAS are available at SvRAO for IVS programs.

CASI

Astronomical Observatories; Radio Astronomy; Very Long Base Interferometry

20050201757 National Inst. of Information and Communications Technology, Tokyo, Japan

Kashima and Koganei 11-m VLBI Stations

Koyama, Yasuhiro; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 68-71; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Two 11-m VLBI stations at Kashima and Koganei used to be a part of the Key Stone Project VLBI Network. The network consisted of four VLBI stations at Kashima, Koganei, Miura, and Tateyama. Since Miura and Tateyama stations have been transported to Tamacomai and Gifu, Kashima and Koganei 11-m stations are remaining as IVS network stations. Since regular VLBI sessions with the Key Stone Project VLBI network terminated in 2001, these stations are mainly used for the purposes of technical developments and various observations. In the year 2004, flux monitoring observations of binary black hole candidates were initiated in collaboration with Gifu University by using the Gifu-Kashim11 baseline. Many observations were also performed to determine precise orbit of the spacecraft Hayabusa.

Author (revised)

Black Holes (Astronomy); Observatories

20050201761 Honeywell Technology Solutions, Inc., USA

Goddard Geophysical and Astronomical Observatory

Redmond, Jay; Kodak, Charles; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 54-57; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes the technical parameters and the technical staff of the VLBI system at the fundamental station GGAO. It also gives an overview about the VLBI activities during the previous year. The outlook lists the outstanding tasks to improve the performance of GGAO.

Author

Astronomical Observatories; Geophysical Observatories

20050201762 Hartebeesthoek Radio Astronomy Observatory, Johannesburg, South Africa

Hartebeesthoek Radio Astronomy Observatory (HartRAO)

Combrinck, Ludwig; Nickola, Marisa; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 58-61; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

HartRAO, the only fiducial geodetic site in Africa, participates in VLBI, GPS and SLR global networks. This report provides an overview of our geodetic VLBI activities during 2004. The status of the 26 m radio telescope surface upgrade is reported. In order to meet future requirements of geodetic VLBI, we have initiated the first steps towards founding a new space geodetic station which will cater to new developments and challenges as addressed by VLBI2010 and future requirements of GPS and SLR/LLR.

Author

Radio Astronomy; Astronomical Observatories; Geodesy; Tracking Networks; Very Long Base Interferometry

20050201764 Naval Observatory, Washington, DC, USA

U.S. Naval Observatory Operation Center

Kingham, Kerry; Carter, Merri Sue; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 143; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report covers the activities of the NEOS Operation Center at USNO for 2004. The Operation Center schedules IVS-R4 and the Intensive experiments.

Author

Observatories; Schedules; Very Long Base Interferometry

20050201767 Consiglio Nazionale delle Ricerche, Italy

The Medicina Station Status Report

Orfei, Alessandro; Maccaferri, Giuseppe; Orlati, Andrea; Mantovani, Franco; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 80-82; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

General information about the Medicina Radio Astronomy Station, the 32 m antenna status and the staff in charge for VLBI operations, are provided. In 204 the data from geodetic VLBI observations were mainly acquired using the MK5A recording system with good results. The station participation in geodetic VLBI observations increased this year compared to previous years.

Author

Radio Astronomy; Very Long Base Interferometry; Radio Telescopes; Geodesy; Astronomical Observatories

20050201880 Michigan Univ., Ann Arbor, MI, USA

Jupiter Thermospheric General Circulation Model (JTGCM): Global Structure and Dynamics Driven by Auroral and Joule Heating

Bougher, S. W.; J. II. Waite, Jr.; Majeed, T.; Journal of Geophysical Research; April 13, 2005; ISSN 0148-0227; Volume 110, pp. 1-25; In English

Contract(s)/Grant(s): NAG5-11031; Copyright; Avail: CASI; [A03](#), Hardcopy

A growing multispectral database plus recent Galileo descent measurements are being used to construct a self-consistent picture of the Jupiter thermosphere/ionosphere system. The proper characterization of Jupiter's upper atmosphere, embedded ionosphere, and auroral features requires the examination of underlying processes, including the feedbacks of energetics, neutral-ion dynamics, composition, and magnetospheric coupling. A fully 3-D Jupiter Thermospheric General Circulation Model (JTGCM) has been developed and exercised to address global temperatures, three-component neutral winds, and neutral-ion species distributions. The domain of this JTGCM extends from 20-microbar (capturing hydrocarbon cooling) to 1.0×10^{-4} nbar (including aurora/Joule heating processes). The resulting JTGCM has been fully spun-up and integrated for greater than or equal to 40 Jupiter rotations. Results from three JTGCM cases incorporating moderate auroral heating, ion drag, and moderate to strong Joule heating processes are presented. The neutral horizontal winds at ionospheric heights vary from 0.5 km/s to 1.2 km/s, atomic hydrogen is transported equatorward, and auroral exospheric temperatures range from approx. 1200-1300 K to above 3000 K, depending on the magnitude of Joule heating. The equatorial temperature profiles from the JTGCM are compared with the measured temperature structure from the Galileo AS1 data set. The best fit to the Galileo data implies that the major energy source for maintaining the equatorial temperatures is due to dynamical heating induced by

the low-latitude convergence of the high-latitude-driven thermospheric circulation. Overall, the Jupiter thermosphere/ionosphere system is highly variable and is shown to be strongly dependent on magnetospheric coupling which regulates Joule heating.

Author

Atmospheric General Circulation Models; Thermosphere; Atmospheric Heating; Jupiter Atmosphere; Auroras; Hydrocarbons; Upper Atmosphere; Ion Distribution

20050201919 Yale Univ. Observatory, New Haven, CT, USA, Naval Observatory, Washington, DC, USA

Definitive Positions and Proper Motions of Primary Reference Stars for Pluto and Rectangular Coordinates of Ceres, Pallas, Juno, Vesta 1920-1960

Morgan, H. R.; *Astronomical Papers*; 1950; Volume 11, Pt. 3, pp. 503-587; In English; No Copyright; Avail: CASI; [A05](#), Hardcopy

The first paper in this document contains a catalog of tables of 255 reference stars for Pluto for the Equinox and Epoch 1950.9. The stars in this list are fairly uniformly spaced over a zone six degrees wide along the apparent path of Pluto, 1930-1950, and extend from 7h 0m to 9h 47m in right ascension, and from +18 deg 30 min to +26 deg 46 min in declination. They range in magnitude from 4m.9 to 9m.1. The second paper in this document gives heliocentric coordinates of four asteroids so that geocentric ephemerides can be prepared for them to facilitate meridian observations so that the equinox and equator may be determined from these observations instead of by the usual method of observing the Sun and bright planets. The document also contains title pages and contents for Volumes X and XI of the *Astronomical Papers Prepared for the Use of American Ephemeris and Nautical Almanac*.

CASI

Pluto (Planet); Reference Stars; Planet Ephemerides; Astrometry; Astronomical Catalogs; Proper Motion; Astronomical Coordinates; Cartesian Coordinates; Ceres Asteroid; Vesta Asteroid

20050202084 Cincinnati Observatory, Cincinnati, OH, USA

Coordinates of Venus 1800-2000

Herget, Paul; *Astronomical Papers*; 1955; Volume 15, Pt. 3, pp. III-523; In English; No Copyright; Avail: CASI; [A14](#), Hardcopy

In 1947 there was initiated with the support of the Office of Naval Research a joint undertaking by the Yale University Observatory, the Watson Scientific Computing Laboratory, and the USA Naval Observatory, for the purpose of improving our knowledge of the motions of the principal planets. An important part of this undertaking consists of determinations of the masses of certain planets and of improved values of certain fundamental astronomical constants, which requires the orbits of selected minor planets to be traced with high precision throughout the period since their discovery. For the calculation of the action of Venus on these minor planets the need was felt for precise coordinates of Venus, calculated on a strictly homogeneous basis for the past century and a half, and sufficiently far into the future to provide for similar foreseeable needs. Coordinates of the requisite nominal precision, extracted from Newcomb's *Tables of Venus*, were already available for part of the period required, either in printed or manuscript form. Comparison among different versions shows, however, that these coordinates, calculated by different persons at different times, cannot be regarded as homogeneous if the highest attainable precision is aimed at. In the use of Newcomb's *Tables* the computer is required to exercise judgment and different computers arrive at slightly different results, not all of which utilize the full accuracy of the *Tables*. The most common deficiency has been the use of linear interpolation which, although it may have been sufficient fifty years ago, is no longer precise enough. In addition to this lack of rigor, printed or manuscript coordinates cannot readily be transcribed in a form suitable for use with high-speed calculating machines; it is easier and more precise to calculate them afresh. Newcomb's *Tables* are out of print, and in any case are too difficult for the use of many who require the coordinates. All these considerations have led to the publication of these data.

Author (revised)

Venus (Planet); Planet Ephemerides; Astronomical Coordinates; Solar Orbits

20050203652 Washington Univ., Saint Louis, MO, USA

Space-Based Gravitational-Wave Observations as Tools for Testing General Relativity

Will, Clifford M.; [2004]; 4 pp.; In English

Contract(s)/Grant(s): NAG5-10186; No Copyright; Avail: CASI; [A01](#), Hardcopy

We continued a project, to analyse the ways in which detection and study of gravitational waves could provide

quantitative tests of general relativity, with particular emphasis on waves that would be detectable by space-based observatories, such as LISA. This work had three foci: 1) Tests of scalar-tensor theories of gravity that, could be done by analyzing gravitational waves from neutron stars inspiralling into massive black holes, as detectable by LISA; 2) Study of alternative theories of gravity in which the graviton could be massive, and of how gravitational-wave observations by space-based detectors, solar-system tests, and cosmological observations could constrain such theories; and 3) Study of gravitational-radiation back reaction of particles orbiting black holes in general relativity, with emphasis on the effects of spin.

Author

Gravitational Waves; Relativity; Spaceborne Astronomy; Black Holes (Astronomy)

20050203839 Naval Observatory, Washington, DC, USA

Heliocentric Coordinates of Ceres, Pallas, Juno, Vesta 1928-2000

Duncombe, Raynor L.; *Astronomical Papers*; 1969; Volume 20, Pt. 2, pp. 135-309; In English; No Copyright; Avail: CASI; [A08](#), Hardcopy

The heliocentric equatorial rectangular coordinates of Ceres, Pallas, Juno, and Vesta given here were generated by an extended precision, Cowell numerical integration of the equations of motion on the IBM 360/40 of the G.W. Hill Scientific Computing Laboratory, U.S. Naval Observatory. Cowell's method has been detailed in many sources, among them *Planetary Co-ordinates 1940-1960*, H.M. Nautical Almanac Office, London 1939, and *Methods of Celestial Mechanics*, D. Brouwer and G. M. Clemence, New York 1961. The frame of reference is defined by the equinox and equator of 1950.0, and the computations incorporate perturbations by all of the principal planets, Venus through Pluto. The mass of the Sun was augmented by the mass of Mercury. The epoch of osculation for all four planets is 1941 January 6.0 E.T. (JD 243 0000.5). Derived from text

Ceres Asteroid; Vesta Asteroid; Astronomical Coordinates; Cartesian Coordinates; Orbit Perturbation; Planetary Gravitation

20050203841 Cincinnati Observatory, Cincinnati, OH, USA

Solar Coordinates 1800-2000

Herget, Paul; *Astronomical Papers*; 1953; Volume 14, pp. III-735; In English; No Copyright; Avail: CASI; [A99](#), Hardcopy

The coordinates of the Sun are fundamental in many problems of dynamical and positional astronomy. This volume contains the coordinates of the Sun at intervals of four days for the 19th and 20th centuries. These data are necessary for several large scale astronomical research problems that are contemplated, and in addition they provide a uniform system of solar coordinates referred to a fixed equinox for use in the reduction of observations of objects in the solar system. The results are based upon Newcomb's *Tables of the Sun*, which have been used as nearly as possible in accordance with the precepts given in his Introduction. One exception is noted later. The interpolation of the double-entry tables was obtained by two applications of the 3-point Lagrange formula. Within any one year (or one revolution of the planet) the vertical argument is constant. The interval of four days was adopted because this is exactly half of the interval upon which the Tables were constructed, and it is nearly an interval of one radian for terms with the period of the moon. A longer interval would not permit reliable interpolation. With this interval the horizontal interpolating factor has a constant value n and $n \pm 1/2$ throughout any one revolution. The lunar terms were handled separately so as to obtain the final coordinates of the Sun both with and without the lunar equation.

Derived from text

Astronomical Coordinates; Celestial Mechanics; Sun; Geocentric Coordinates; Earth-Moon System; Center of Gravity

20050203849 Washington Univ., Saint Louis, MO, USA

Jet-Intracluster Medium Interactions of the Head Tail Radio Galaxy 3C 129

Krawczynski, Henric S. W.; [2005]; 2 pp.; In English

Contract(s)/Grant(s): NAG5-13086; No Copyright; Avail: CASI; [A01](#), Hardcopy

The 50 ksec XMM observations of the galaxy cluster 3C 129 were taken as scheduled, and the data are of good quality. We analyzed the data in the following way. After standard cleaning, we flat-fielded the XMM surface brightness maps. Combining the data from the EPIC MOS and PN Camera CCDs, we performed a cross-correlation analysis of the X-ray surface brightness distribution with the 1.4 GHz VLA radio map. We found evidence for cavities in the X-ray emitting Intra-Cluster Medium (ICM) associated with the radio tail of the head-tail radio galaxy 3C 129. This discovery is very interesting as it excludes the presence of a large fraction of thermal plasma in the radio tail. Together with the observation of an apparent pressure mismatch between the radio plasma and the ICM, and an upper limit on the magnetic field inside the radio tail (from the radio spectral indices map) the observation implies that the tail pressure is dominated either by low-energy

electrons/positrons, or, by relativistic protons. Furthermore, we studied the energy spectrum of an X-ray ‘hot-spot’ associated with the head of the radio galaxy 3C 129. It seems likely that the X-ray hot-spot originates from shocked gas in front of the radio galaxy. , The analysis turned out to be much more difficult than anticipated. The main reason is the lack of a comprehensive, publicly available background model that is key for the analysis of extended sources. Small groups like our do not have the man-power to come up with a background model themselves. We used the model from Read & Ponman (A&A 409, 395, 2003). However, the background subtracted X-ray surface brightness maps show a bright ring in the outer 20% of the camera. We tried to get rid of this ring and contacted the XMM helpdesk and Read & Ponman, the authors of the background paper. However, up to this day, we did not entirely succeed to remove the brightness enhancement at the outer parts of the camera. Unfortunately, our results are somewhat sensitive to the uncertainty, as the radio galaxy 3C 129 is very large and occupies a rather large fraction of the XMM field of view. We are now working on a paper describing the results. The paper will include a detailed discussion of the uncertainties associated with the non- perfect background subtraction.

Author

Radio Galaxies; Galactic Clusters; Cross Correlation; Brightness Distribution; Energy Spectra; X Rays; Magnetic Fields

20050203851 Michigan Univ., Ann Arbor, MI, USA

Integrated Modeling Study of the Effects of the Magnetospheric Forcing on the Jovian Ionosphere-Thermosphere System

Bogan, Denis, Technical Monitor; Waite, J. Hunter; August 1, 2005; 24 pp.; In English

Contract(s)/Grant(s): NAG5-11031; NSF AST-03-00005; No Copyright; Avail: CASI; [A03](#), Hardcopy

The Jupiter Thermosphere General Circulation Model (JTGCM) calculates the global dynamical structure of Jupiter's thermosphere self-consistently with its global thermal structure and composition. The main heat source that drives the thermospheric flow is high-latitude Joule heating. A secondary source of heating is the auroral process of particle precipitation. Global simulations of Jovian thermospheric dynamics indicate strong neutral outflows from the auroral ovals with velocities up to approx. 2 km/s and subsequent convergence and downwelling at the Jovian equator. Such circulation is shown to be an important process for transporting significant amounts of auroral energy to equatorial latitudes and for regulating the global heat budget in a manner consistent with the high thermospheric temperatures observed by the Galileo probe. Adiabatic compression of the neutral atmosphere resulting from downward motion is an important source of equatorial heating (~ 0.06 microbar). The adiabatic heating continues to dominate between 0.06 and 0.2 microbar, but with an addition of comparable heating due to horizontal advection induced by the meridional flow. Thermal conduction plays an important role in transporting heat down to lower altitudes (~ 0.2 microbar) where it is balanced by the cooling associated with the wind transport processes. Interestingly, we find that radiative cooling caused by H₃⁺, CH₄, and C₂H₂ emissions does not play a significant role in interpreting the Galileo temperature profile.

Author

Atmospheric General Circulation Models; Thermosphere; Heat Sources; Conductive Heat Transfer; Jupiter Atmosphere; Temperature Distribution

20050203963 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

An evolving trio of hybrid stars: C111

Sonneborn, George, Technical Monitor; Dupree, Andrea K.; August 2005; 5 pp.; In English

Contract(s)/Grant(s): NAG5-12478

Report No.(s): SAO-P5262-12-01; No Copyright; Avail: CASI; [A01](#), Hardcopy

Hybrid stars are a class of cool, luminous single stars originally identified based on the appearance of their ultraviolet IUE spectra. C IV emission is present (signifying temperatures of at least 10^5 K), and asymmetric emission cores of Mg II are found, accompanied by absorption features at low and high velocities, indicating a massive stellar wind and circumstellar material. Many members of this class have been identified and X-rays have been detected from most hybrids. They represent the critical evolutionary state between coronal-like objects and the Alpha Ori-like objects and assume a pivotal role in the definition of coronal evolution, atmospheric heating processes, and mechanisms to drive winds of cool stars.

Derived from text

Hybrid Structures; Stars; Cool Stars; Iue; X Rays

20050203970 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Astrometric and Photometric Follow-up of Faint Near Earth Objects

Morgan, T., Technical Monitor; Spahr, Timothy; July 2005; 2 pp.; In English

Contract(s)/Grant(s): NAG5-13304; No Copyright; Avail: CASI; [A01](#), Hardcopy

During the period April 2003 - April 2005, roughly 150 different faint NEO's were observed using the 1.2-m telescope at Mt. Hopkins. Among these were a couple of spacecraft/radar targets, including support observations in support of the Deep Impact mission. While not strictly an NEO target, comet P/Tempel 1 was nonetheless observed as an object of very high importance. During this time and independent contractor, Kyle Smalley, was trained in the use of the telescope and provided some basic software support for the project.

Author

Astrometry; Faint Objects; Near Earth Objects; Photometry

20050203971 Space Telescope Science Inst., Baltimore, MD, USA

Outbursts in Symbiotic Binaries: Z and Continued Observation

Sonneborn, George, Technical Monitor; Keyes, Charles; August 15, 2005; 4 pp.; In English

Contract(s)/Grant(s): NAG5-13696; STScI Proj. J1075; No Copyright; Avail: CASI; [A01](#), Hardcopy

A major question for symbiotic stars concerns the nature and cause of their outbursts. A small subset of symbiotics, the 'slow novae' are fairly well established as thermonuclear events that last on the order of decades. The several symbiotic 'recurrent novae', which are much shorter and last on the order of months, are also thought to be thermonuclear runaways. Yet the majority of symbiotics are neither slow novae nor recurrent novae. These are the so-called 'classical symbiotics,' many of which show outbursts whose cause is not well understood. In some cases, jets are produced in association with an outburst, therefore an investigation into the causes of outbursts will yield important insights into the production of collimated outflows. To investigate the cause and nature of classical symbiotic outbursts, we initiated a program of multi-wavelength observations of these events. First of all in FUSE Cycle 2, we obtained six observational epochs of the 2000-2002 classic symbiotic outburst in the first target of our campaign - class prototype, Z Andromedae. That program was part of a coordinated multi-wavelength Target-of-Opportunity (TOO) campaign with FUSE, XMM, Chandra, MERLIN, the VLA, and ground-based spectroscopic and high time-resolution photometric observations. Our campaign proved the concept, utility, and need for coordinated multi-wavelength observations in order to make progress in understanding the nature of the outburst mechanisms in symbiotic stars. Indeed, the FUSE data were the cornerstone of this project. The present program is a continuation of that cycle 2 effort. Indeed, the observations acquired in this program are vital to the proper interpretation of the material acquired in cycle 2 as the new data cover the critical time period when the star continues to decline from outburst and actually returns to quiescence. The utilization of these data have allowed us to refine and complete description of our new model for classical symbiotic system outbursts.

Author

Symbiotic Stars; Binary Stars; Andromeda Constellation

20050203972 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

A1367: A Cluster in Formation

Mushotzky, Richard, Technical Monitor; Forman, William; February 2005; 3 pp.; In English

Contract(s)/Grant(s): NAG5-10029; No Copyright; Avail: CASI; [A01](#), Hardcopy

A1367 is a puzzling cluster with a large elongation, suggesting a major merger but with an anti-correlation between the luminosity and temperature of the two components of the cluster (NE and SW). The less luminous subconcentration appears hotter and the more luminous portion of the cluster appears cooler in contradiction to the well-established positive correlation of temperature and luminosity for clusters and groups. A1367 lies at the intersection of two large scale filaments in our local Universe - one in the direction of the Coma cluster and a second in the direction of the Virgo cluster. The elongation of the main X-ray structure lies along the Virgo-A1367 filament. With the XMM-Newton observation we have developed a model involving multiple mergers from two directions to explain the observed features of A1367.

Author

Virgo Galactic Cluster; Luminosity; X Rays; Elongation

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20050199697 International Business Machines Corp., Yorktown Heights, NY, USA

The Motion of the Moon as Computed by the Method of Hill, Brown, and Eckert, Volume 23, Part 1

Gutzwiller, Martin C.; Schmidt, Dieter S.; 1986; 267 pp.; In English; No Copyright; Avail: CASI; [A12](#), Hardcopy

The main problem of lunar theory is solved by the method which was first used by Ernest W. Brown around the turn of the century. The algebraic manipulations are done by special algorithms on a high-speed computer as was first suggested and partially carried out by Wallace J. Eckert before his death in 1971. A self-contained report and extensive tables are presented. The main problem of lunar theory considers three point masses, the Moon M, the Earth E, and the Sun S which interact by the inverse square force of gravitation. The center of mass for E and M moves on a fixed Kepler ellipse (semi-major axis a' and eccentricity e') around the S. The three second order ordinary differential equations for the motion of M relative to E are solved in a Cartesian coordinate system which rotates with the mean position of S. The solutions are expanded around the periodic orbit (also called Hill's intermediate or variational orbit) of M around E in the plane of the ecliptic. The report consists of four, roughly equal parts. Chapter I and II give the Hill-Brown theory and a description of the tables. The variational orbit is defined, and the first-order corrections are discussed in detail, yielding the motions of the perigee and the node. The general form of the solution is written down, and the method for going from one order to the next is described. Special attention is given to finding higher order corrections to the motions of perigee and node, and to defining the empirical values for the expansion parameters. Chapter III is devoted to the computational methods. A special package of computer programs called POLYPAK is used whose principal subroutines are enumerated. The algorithms for obtaining the variational orbit as well as the mean motions in lowest order, and for going on to the orders beyond the first are explained. Finding the right-hand sides of the linear equations, and then solving them is discussed. A major effort is devoted to finding the derivative of the series with respect to the numerical parameter m , by appealing to the canonical nature of the equations of motion. Methods of Lie transforms play a major role throughout.

Author (revised)

Moon; Hill Lunar Theory; Three Body Problem; Solar Gravitation; Earth Gravitation; Gravitational Effects; Orbit Calculation

20050199735 Lawrence Livermore National Lab., Livermore, CA USA

Standard Formats for Atomic Data: the APED

Smith, R. K.; Brickhouse, N. S.; Liedahl, D. A.; Raymond, J. C.; Jun. 05, 2001; 12 pp.; In English

Report No.(s): DE2005-15013359; UCRL-JC-144164; No Copyright; Avail: Department of Energy Information Bridge

Standardized formats for atomic data used for calculating emission from a collisionally-ionized plasma are described. The formats use the astronomical-standard FITS format, and are extendible to other purposes, such as photoionization data. The formats emphasize storing references to the original data source and keeping the data in as-received for, to aid in checking against the original literature.

NTIS

Atomic Physics; Atoms; Collisional Plasmas; Emission Spectra; Format; Plasma Radiation; Space Plasmas

20050201725 Crimean Astrophysical Observatory, USSR

10 Years of Geodetic Experiments at the Simeiz VLBI Station

Volvach, Alexandr; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 100-103; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report gives an overview of the geodetic VLBI activities during 10 years at Simeiz station. The positions of the points in the fundamental geodynamics area 'Simeiz-Katsively' have been determined by special GPS survey campaign. It also summarizes the seasonal and long-term variability of the Black Sea level near Yalta and Katsively.

Author

Geodesy; Very Long Base Interferometry; Global Positioning System; Annual Variations; Geodynamics

20050201727 Naval Observatory, Washington, DC, USA

USNO Analysis Center for Source Structure Report

Fey, Alan L.; Boboltz, David A.; Gaume, Ralph A.; Kingham, Kerry A.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 251-254; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

This report summarizes activities of the U.S. Naval Observatory Analysis Center for Source Structure for 2004. VLBA RDV experiment RDV45 was calibrated and imaged. VLBA high frequency (24 and 43 GHz) experiments BL115B and BL115C were calibrated and imaged. A new method for quantifying source structure was developed. A Southern Hemisphere

imaging and astrometry program for maintenance of the ICRF continued. Imaging of an additional 60 southern hemisphere ICRF sources at 8.4 GHz was completed

Author

Very Long Baseline Array (VLBA); Calibrating; Astrometry; Imaging Techniques; Ion Cyclotron Radiation; Observatories; Radio Frequency Heating

20050201745 Tasmania Univ., Hobart, Australia

Hobart, Mt Pleasant, Station Report for 2004

Ellingen, Simon; Reid, Brett; Dickey, John M.; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 62-63; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

This is a brief report on the activities carried out at the Mt. Pleasant Radio Astronomy Observatory at Hobart, Tasmania. During 2004, the Observatory participated in 44 VLBI observing sessions with IVS.

Author

Observatories; Radio Astronomy; Very Long Base Interferometry

20050201754 Massachusetts Inst. of Tech., MN, USA

Haystack Observatory Technology Development Center

Whitney, Alan; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 264-267; In English; See also 20050201697; Original contains color illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Work at MIT Haystack Observatory is currently focusing on: 1.) Studies for a new geodetic-VLBI system based on small antennas and e-VLBI; 2.) Development of e-VLBI; and 3.) Development of Mark 5 VLBI data system.

Author

Very Long Base Interferometry; Observatories; Geodesy; Data Systems

20050201760 Bonn Univ., Germany

Analysis Coordinator Report

Nothnagel, Axel; Steinforth, Christoph; International VLBI Service for Geodesy and Astrometry 2004 Annual Report; March 31, 2005, pp. 28-30; In English; See also 20050201697; No Copyright; Avail: CASI; [A01](#), Hardcopy

IVS analysis coordination issues from 2004 are reported here.

Author

Coordination; Very Long Base Interferometry; Geodesy; Computer Programs; Astrometry

20050201968 Lawrence Livermore National Lab., Livermore, CA USA

Case a Binary Evolution

Nelson, C. A.; Eggleton, P. P.; Mar. 28, 2001; 18 pp.; In English

Report No.(s): DE2005-15013306; UCRL-JC-143307; No Copyright; Avail: Department of Energy Information Bridge

We undertake a comparison of observed Algo-type binaries with a library of computer Case A binary evolution tracks. The library consists of 5500 binary tracks with various values of initial primary mass $M(\text{sub } 10)$, mass ratio $q(\text{sub } 0)$, and period $P(\text{sub } 0)$, designed to sample the phase-space of Case A binaries in the range -0.10 greater than or equal to $\log M(\text{sub } 10)$ greater than or equal to 1.7. Each binary is evolved using a standard code with the assumption that both total mass and orbital angular momentum are conserved. The code follows the evolution of both stars until the point where contact or reverse mass transfer occurs.

NTIS

Binary Stars; Mass Transfer

20050201997 Lawrence Livermore National Lab., Livermore, CA USA

Chemical Inhomogeneities and Pulsation

Turcotte, S.; Oct. 09, 2001; 14 pp.; In English

Report No.(s): DE2005-15013380; UCRL-JC-144692; No Copyright; Avail: Department of Energy Information Bridge

Chemical composition plays an important role in determining the structure of stars. Its influence comes mostly through the sensitivity of opacities on the atomic spectra and absorption features of the elements making up a star. As most variable

stars are unstable precisely because of how opacity behaves in relations to perturbations, it stands to reason that chemical composition be of fundamental interest when studying pulsating stars.

NTIS

Chemical Composition; Variable Stars; Sensitivity

20050202088 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Confirmation Of Thick Whim At Z-0.1 In Sculptor Supercluster

Nicastro, Fabrizio; August 2005; 2 pp.; In English

Contract(s)/Grant(s): NNG04GF20G; No Copyright; Avail: CASI; [A01](#), Hardcopy

This grant is associated to an XMM observation of the quasar QSO Q0056-363 (PI: Dr. Roberto Maiolino), which is one of the brightest quasars in the X-ray sky, and it lies in the general direction of the Sculptor Supercluster, and behind it. We requested the observation to check a previous hint of existence of an absorption features by highly ionized gas at the redshift of the Supercluster, which we supposed to be the imprint of a Warm-Hot Intergalactic Medium filament connecting the already virialized structures in the Supercluster. The observation suffered a high background, and so the net exposure was considerably reduced compared to the requested exposure. Additionally the quasar turned out to be in a quite low level of activity. These two unfortunate facts made it impossible to confirm or rule-out at high resolution (i.e. with the RGS) the existence of the previously hinted OW1 K-alpha resonant line at the redshift of the Sculptor Supercluster, the new RGS data being sensitive only to equivalent width of unresolved absorption lines of about 30-50 mÅ at 1-sigma. The data, however, shows a very strong absorption line in a position different from the OVII/OVIII K-alpha at the redshift of the Supercluster. If this line is interpreted as OVII/OVIII K-alpha absorption, the redshift of this WHIM filament would lie in a region of the Universe where no visible virialized concentrations are present. This would confirm the relatively high probability of detecting WHIM filaments in apparent 'void' regions of the Universe (as previously suggested by our first detection of WHIM filaments at z greater than 0 along the line of sight to the blazar Mkn 421). A paper on the non-detection of any WHIM filament at the redshift of the Sculptor Supercluster, as well as on the detection of this putative WHIM filament in a 'void', will be shortly submitted to the *ApJ*.

Author

Quasars; X Ray Astronomy; Galactic Clusters; Solar Prominences; Intergalactic Media

20050203643 Washington Univ., Saint Louis, MO, USA

Basic Research on the Composition of Heavy Cosmic Rays: The Trans-Iron Galactic Element Recorder Experiment (TIGER)

Binns, W. Robert; [2004]; 7 pp.; In English

Contract(s)/Grant(s): NAG5-5343; No Copyright; Avail: CASI; [A02](#), Hardcopy

Among the most fundamental astrophysical problems is understanding the mechanism by which particles are accelerated to the enormous energies observed in the cosmic rays. That problem can be conveniently divided into two questions: (1) What is the source of the energy and the mechanism for converting the energy of that source into the energy of individual cosmic-ray nuclei, and (2) what is the source of the material that is accelerated and the mechanism for injecting that material into the cosmic-ray accelerator? There is a general consensus that the answer to the first of these questions, for nuclei with energy eV, is that the source of their energy is almost certainly from supernova explosions (e.g., Ginzburg & Syrovatskii, 1964). The answer to the second question is still uncertain, although evidence in favor of a superbubble origin of cosmic rays is becoming quite significant (Higdon et al, 2003 and Binns, 2005 (Submitted to *ApJ*)). There are several ways of interpreting available data that lead to quite different models for the source of the material and its injection mechanism. With the The Trans-Iron Galactic Element Recorder Experiment (TIGER) instrument we have obtained data that will help to distinguish among these possible models. In the report, the TIGER flights, the instrument itself, results, and a publication list as a result of the work are presented.

Derived from text

Galactic Cosmic Rays; Scintillation Counters; Cerenkov Counters; Cosmic Rays

LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20050201815 Lunar and Planetary Inst., Houston, TX, USA

Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters

[2005]; ISSN 0161-5297; 122 pp.; In English; The Role of Volatiles and Atmospheres on Martian Impact Craters, 11-13 Jul. 2005, Laurel, MD, USA; See also 20050201816 - 20050201869

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1273; Copyright; Avail: CASI; [A06](#), Hardcopy

This volume contains abstracts that have been accepted for presentation at the Workshop on the Role of Volatiles and Atmospheres on Martian Impact Craters, July 11-14, 2005, Laurel, Maryland. Administration and publications support for this meeting were provided by the staff of the Publications and Program Services Department at the Lunar and Planetary Institute. Derived from text

Mars Craters; Mars Surface; Geophysics; Planetary Geology; Ejecta

20050201816 Arizona Univ., Tucson, AZ, USA

Impact-induced Hydrothermal Activity at Central-Peak and Peak-Ring Craters on Early Mars

Abramov, O.; Kring, D. A.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 13-14; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Impact events locally increase the temperature of a planetary crust, initiating hydrothermal activity if water or ice is present. Impact-induced hydrothermal activity is responsible for mineralogically and morphologically modifying many terrestrial craters [e.g., 1], and has been suggested for Martian craters [2, 3]. While there are probably no active impact-induced hydrothermal systems today, they may have been prevalent at approx. 3.9 Ga, during an intense period of bombardment lasting 20 to 200 Ma [4, 5]. This cataclysm likely affected Mars, because meteorites from the asteroid belt, as well as the only sample of the ancient Martian crust (meteorite ALH 84001), show effects of impact-induced metamorphism at approx. 3.9 Ga [6, 7]. Thus, we are focusing on an early Martian environment because it coincides with a sharply higher impact rate, and also because liquid water was likely stable in the subsurface and perhaps on the surface as well.

Derived from text

Mars Craters; Metamorphism (Geology); Hydrothermal Systems; Planetary Crusts; Meteorites; Planetary Geology

20050201817 Tokyo Univ., Japan, Johns Hopkins Univ., Laurel, MD, USA

The Runout Efficiency of Fluidized Ejecta on Mars

Barnouin-Jha, O. S.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 21-22; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

The distance from rim-crest to distal rampart has typically been used to determine the fluidity of Martian ejecta [e.g., 1]. When craters of a given size possess longer rim-to-rampart distances, these studies typically assume that greater amounts of volatiles are present within the ejecta. Such rim-to-rampart distances have also been shown to increase as $R_c(\sup 1/2)$, where R_c is the crater radius. Such a relationship is expected from impact experiments in an atmosphere [2]. In this study, runout efficiency (i.e., U/H analyzes where L is the runout distance and H is onset height) is used. This efficiency allows to broadly characterize the rheology of landslides on Earth [e.g., 3, 4 and references therein] and the planets [e.g., 5, 6]. It varies mostly with the volume of a landslide, but is also influenced by other factors including the presence of water [e.g., 3, 4 and references therein]. In the case of very large landslides ($\sim 10^{10} \text{ km}^3$), L depends primarily on the flow volume [7], although differences in rheology remain important.

Derived from text

Ejecta; Landslides; Mars Surface; Craters; Radii

20050201818 Arizona Univ., Tucson, AZ, USA

Arcuate Ridges and Gullies in Martian Craters: Dependence on Orientation and Latitude

Berman, D. C.; Hartmann, W. K.; Crown, D. A.; Baker, V. R.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 23-24; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

At the bases of many mid-latitude crater walls, arcuate ridges with sharp crests can be seen [1,2]. These features are usually located at the bottom of gullied walls of craters, but gullies are not always present above them. Stratigraphically, the debris aprons of gullies overlie the crater wall-facing slopes of arcuate ridges, where the two features coexist, and the debris aprons may infill the region between the base of the crater wall and the arcuate ridge. Some ridges are only slightly sinuous and form one continuous ridge around a portion of the interior crater wall, but in most cases ridges appear as individual features that abut one another. They are often associated with lineations and pitted textures extending onto crater floors. The arcuate ridges resemble terrestrial protalus ramparts or terminal moraines [3,4,5], which suggests they may have a glacial origin. A general survey [2] has shown these features to be common in certain mid-latitude regions.

Derived from text

Mars Craters; Latitude; Textures; Walls; Debris; Slopes; Glacial Drift

20050201819 Smithsonian Institution, Washington, DC, USA

Modified Impact Craters on Mars: Observations, Measurements and Likely Processes

Craddock, Robert A.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 34-35; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Modified impact craters on Mars were first recognized in early Mariner spacecraft images. From these data, Leighton et al. [1] showed that martian craters are in widely different degrees of preservation, which they presumed to be a function of age. Inspired by Manner 9 spacecraft observations of global dust storm activity Hartmann [2] suggested that eolian processes that had removed and redistributed loose crater ejecta over time could explain the morphologies of modified impact craters. Analyses of impact crater populations suggested that Mars had fewer small diameter impact craters than were observed on the moon, leading Jones [3] and Chapman and Jones [4] to the conclusion that water eroded many of the smaller martian craters during an early obliteration event. Based on Viking data, Arvidson et al. [5] suggested volcanism as yet another possible process responsible for crater modification. Interestingly, despite the improvement in image resolution and clarity eolian processes continued to be the favored process for crater modification by many investigators during the Viking era [6, 7, 8]. However, as topographic data and improved high-resolution images became available from the suite of spacecraft currently orbiting Mars it has become increasingly apparent that only a combination of fluvial processes is capable of explaining the styles of crater morphology, the timing of modification, and the estimated amount of erosion [9, 10, 11, 12,13].

Derived from text

Mars Craters; Mars Environment; Mariner Spacecraft; Dust Storms; Ejecta; Erosion; Planetary Geology; Satellite Observation

20050201822 Brown Univ., Providence, RI, USA

Assessing Lithology from Ejecta Emplacement Styles on Mars: The Role of Atmospheric Interactions

Schultz, P. H.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; See also 20050201815; Copyright; Avail: CASI

There is little question that Mars once had water flowing across the surface and that there are reservoirs currently sustaining the near-surface volatiles at high latitudes. Neither observation, however, establishes water as the controlling ingredient for the distinctive ejecta morphologies surrounding craters on Mars. The purpose of this contribution is to review the alternative hypothesis that the atmosphere is not only a controlling factor but also the controlling process. Such a position is not offered as an extreme end member but as balance to the popular perception that craters can be used as diagnostic indicators of volatile content or groundwater depth. The following is intended to be a review of the basic model and its implications for ejecta emplacement on Mars.

Derived from text

Mars Craters; Lithology; Ground Water; Ejecta

20050201824 LogicaCMG UK Ltd., Leatherhead, UK

Automatic Recognition of Crater-like Structures in Terrestrial and Planetary Images

Earl, Jon; Chicarro, Agustin; Koeberl, Christian; Marchetti, Pier Giorgio; Milnes, Martin; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 36-37; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Impact cratering is a fundamental process acting on solid bodies of the solar system. The detection of impact craters on Earth may be aided by recent advances in remote sensing technologies, although visual inspection of large number of satellite images are probably too time consuming. We describe new efforts regarding recognition and detection of impact craters on

Earth and Mars by using remote sensing images. In particular, approaches based on the Hough Transform and on the Radial Consistency measure are considered and compared.

Author

Terrestrial Planets; Remote Sensing; Mars Craters; Satellite Imagery; Visual Observation

20050201825 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Field Studies of Crater Gradation in Gusev Crater and Meridiani Planum Using the Mars Exploration Rovers

Grant, J. A.; Golombek, M. P.; Haldemann, A. F. C.; Crumpler, L.; Li, R.; Watters, W. A.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 42-43; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

The Mars Exploration Rovers Spirit and Opportunity investigated numerous craters since landing in Gusev crater (14.569degS, 175.473degE) and Meridiani Planum (1.946degS, 354.473degE) over the first 400 sols of their missions [1-4]. Craters at both sites are simple structures and vary in size and preservation state. Comparing observed and expected pristine morphology and using process-specific gradational signatures around terrestrial craters as a template [5-7] allows distinguishing gradation processes whose relative importance fundamentally differs from those responsible for most crater modification on the Earth.

Derived from text

Mars Craters; Mars Exploration; Mars Surface; Morphology; Roving Vehicles; Mars Landing Sites

20050201826 Arizona Univ., Tucson, AZ, USA

‘Softening’ of Martian Impact Craters by Creep of Ice-rich Permafrost

Turtle, E. P.; Pathare, A. V.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Since the initial Mariner 9 mapping of Mars, researchers have noted the curious softened characteristics of high-latitude terrain, which are widely theorized to result from the viscous creep of a near-surface layer of ice-rich permafrost within the Martian megaregolith [e.g., 1-5]. Squyres and Carr [4] classified creep-related landforms, including: (1) debris aprons, produced by mass wasting along escarpments, examples of which include lobate debris aprons, lineated valley fill, and concentric crater fill; and (2) terrain softening, resulting from in situ viscous deformation, which is most clearly expressed by craters with degraded rims and flattened topographic profiles (Fig. 1). Squyres [5] also conducted finite-element simulations that qualitatively established the ability of viscous creep deformation to reproduce the morphologies of craters in martian softened terrain. Jankowski and Squyres [6] subsequently performed a more quantitative analysis of Martian crater relaxation, concluding that the morphology of midlatitude craters is consistent with relaxation in a deforming layer no more than 1 km deep. In order to explain the extent of terrain softening observed by [5] with a two-layer model, Jankowski and Squyres [6] required subsurface ice equivalent to a global layer of water 17 m thick, a figure which rises to 55 m if likely locations of terrain softening are included and 125 m if softening conditions are met everywhere poleward of 30deg latitude.

Derived from text

Mars Craters; Morphology; Permafrost; Planetary Geology; Planetary Mapping; Softening

20050201828 California Univ., Santa Cruz, CA, USA

Crater Lakes on Mars: Development of Quantitative Thermal and Geomorphic Models

Barnhart, C. J.; Tulaczyk, S.; Asphaug, E.; Kraal, E. R.; Moore, J.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Impact craters on Mars have served as catchments for channel-eroding surface fluids, and hundreds of examples of candidate paleolakes are documented [1,2] (see Figure 1). Because these features show similarity to terrestrial shorelines, wave action has been hypothesized as the geomorphic agent responsible for the generation of these features [3]. Recent efforts have examined the potential for shoreline formation by wind-driven waves, in order to turn an important but controversial idea into a quantitative, falsifiable hypothesis. These studies have concluded that significant wave-action shorelines are unlikely to have formed commonly within craters on Mars, barring Earth-like weather for approx.1000 years [4,5,6].

Derived from text

Geomorphology; Mars Craters; Temperature Distribution; Lakes

20050201829 University of Northern Arizona, Flagstaff, AZ, USA

The Influence of Volatiles and Atmospheres on Martian Impact Crater Morphologies

Barlow, N. G.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Impact craters on Mars display a variety of morphologic features which differ from those seen with craters on dry, atmosphereless bodies like the Moon. These morphologies include layered ('fluidized') ejecta blankets and central pits. The layered ejecta morphologies have been proposed to result from impact into subsurface volatile reservoirs, interactions of the ejecta curtain with the martian atmosphere, or a combination of both processes. Central pits have been proposed to result from impact into volatile-rich targets and/or cometary impacts. Analysis of MGS, Odyssey, and Mars Express data, combined with recent laboratory experiments and numerical modeling, is revealing new insights into the role of volatiles and atmospheres in the formation of these features.

Derived from text

Mars Atmosphere; Mars Craters; Morphology; Ejecta; Mars Surface; Mars Express

20050201830 Paris-Sud Univ., Orsay, France

Perched Craters and Episodes of Sublimation on Northern Plains

Meresse, S.; Baratoux, D.; Costard, F.; Mangold, N.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 75-76; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Data from the MOLA instrument have revealed in detail the morphometry and topography of the impact craters and lobate ejecta deposits on Mars. We report in this study the observation of craters in the Northern lowlands where the cavity and the fluidized ejecta blankets are topographically perched above the surrounding terrain. This 'perched crater' morphology clearly differs from fresh craters one: the cavity has undergone a filling up over a hundred of meters and the ground at the vicinity of the ejecta seems to be eroded (Fig.1). Moreover those perched craters can not be considered as pedestal craters. Even if pedestal craters are also topographically perched [1] they never display double layer ejecta morphology (DLE) [1] as we can observe in some perched craters (Fig.1). The diameters of the perched craters are always smaller than 10 km and the cavities are on average 70 meters above the surrounding surface. (Fig.1-4) The perched craters have been solely detected between 40deg' and 70degN and our research was limited to Acidalia and Utopia Planitia. This distribution is consistent with the occurrence of one or several episodes of deflation/erosion in the Northern lowlands. In this study, we focus on morphometric and thermal properties of the discovered morphology with the objective to understand the mechanism of erosion which could preserve the ejecta but erode the intercraters plain. The role of ice-sublimation in this process has also to be determined.

Derived from text

Planetary Geology; Mars Surface; Morphology; Pressure Reduction; Topography; Thermodynamic Properties

20050201831 University of Northern Arizona, Flagstaff, AZ, USA

A New Model for Pedestal Crater Formation

Barlow, N. G.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Pedestal craters are unique landforms on Mars where both the crater and ejecta blanket are elevated above the surrounding terrain. The distributions and characteristics of these craters indicate that they form within a fine-grained layer. Traditionally, eolian deflation of the surrounding material has been the proposed formation mechanism. However, new models of the latitudinal distribution of ice-rich mantles suggest that pedestal craters may result from sublimation of the surrounding ice-rich material.

Author

Mars Surface; Planetary Geology; Models; Mars Craters; Geomorphology

20050201836 Carnegie Institution of Washington, USA

Dispersion and Mixing of Impact-generated Aerosols in the Martian Middle Atmosphere

Cho, J. Y-K.; Stewart, S. T.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Large bolide impacts on the Martian surface load the atmosphere with long-lived, fine-scale particles by direct injection and ballistic fallout. When the particles enter the middle atmosphere, the vertically stable region above the troposphere (0 to

approximately 50 km altitude), they remain aloft for very long times of months to years depending on the particle size. There, the emplaced particles are dispersed in a highly complex spatial pattern by the strong, prevailing winds. The detailed evolution of dispersion and mixing of particles in the middle atmosphere has not been addressed. This is due in part to the high resolution and complexity required to accurately track the dispersion for longer than very short times (approximately minutes to approximately hours). We study the nonlinear dispersion of aerosols over meteorologically significant time of approximately 10 sols using a high-resolution (approximately 30 km) atmospheric flow model. The model uses the spectral method to solve the atmospheric dynamics equations (the primitive equations) and is capable of resolving the dynamical structures (waves, eddies, and turbulence) critical for accuracy. The model is loaded with the MOLA topography, winds from a full Mars general circulation model of Richardson and Wilson at different seasons, and starting particle coverage similar to those in Kring and Durda for shallow and steep velocity distributions. Using the model, we study the spreading rates, mixing extent, and potential for global transport in events from approximately 10 to approximately 100 km-sized impactors in many different physical conditions (e.g., season, impact location, spatial-temporal distribution of injected particles, strength of topographic waves, etc.).

Derived from text

Aerosols; Mars Atmosphere; Middle Atmosphere; Dispersion

20050201837 NASA Ames Research Center, Moffett Field, CA, USA

The Effect of Impacts on the Martian Climate

Colaprete, A.; Haberle, R. M.; Segura, T. L.; Toon, O. B.; Zahnle, K.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Evidence for the presence of liquid water early in Mars history continues to accumulate. The most recent evidence for liquid water being pervasive early in Mars history is the discoveries of sulfate and gypsum layers by the Mars Exploration Rovers and Mars Express. However, the presence of liquid water at the surface very early in Mars history presents a conundrum. The early sun was most likely approximately 75% fainter than it is today. About 65-70 degrees of greenhouse warming is needed to bring surface temperatures to the melting point of water. To date climate models have not been able to produce a continuously warm and wet early Mars. This may be a good thing as there is morphological and mineralogical evidence that the warm and wet period had to be relatively short and episodic. The rates of erosion appear to correlate with the rate at which Mars was impacted thus an alternate possibility is transient warm and wet conditions initiated by large impacts. It is widely accepted that even relatively small impacts (approximately 10 km) have altered the past climate of Earth to such an extent as to cause mass extinctions. Mars has been impacted with a similar distribution of objects. The impact record at Mars is preserved in the abundance of observable craters on its surface. Impact induced climate change must have occurred on Mars.

Derived from text

Climate Change; Mars Environment; Mars Craters; Hypervelocity Impact

20050201838 NASA, Washington, DC, USA

Impact Craters on Mars: Natural 3D Exploration Probes of Geological Evolution

Garvin, James B.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 38-39; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: The population of impact craters preserved on the surface of Mars offers fundamental constraints on the three-dimensional mechanical characteristics of the martian crust, its volatile abundance, and on the styles of erosion that have operated during essentially all epochs of martian geological history. On the basis of the present-day wealth of morphologic and geometric observations of impact landforms on Mars [1-31], an emerging understanding of the three-dimensional physical properties of the martian uppermost crust in space and time is at hand. In this summary, the current basis of understanding of the relatively non-degraded population of impact landforms on Mars is reviewed, and new Mars Global Surveyor (MGS)-based (MOLA) measurements of global geometric properties are summarized in the context of upcoming observations by Mars Reconnaissance Orbiter (MRO).

Derived from text

Mars Surface; Craters; Landforms; Planetary Crusts; Planetary Geology

20050201839 Brown Univ., Providence, RI, USA

Subkilometer-scale Roughness of Crater Ejecta in the Northern Plains of Mars: Implications for Climate-related Alteration

Kreslavsky, M. A.; Hear, J. M.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

This study is a follow-up of our work on statistical analysis of surface slopes from MGS MOLA data. We have used profile slopes and curvatures measured along MOLA tracks at different baselines to characterize the roughness of the surface at scales from MOLA shot-to-shot distance (0.3 km) to tens of kilometers. Among other interesting things, we have found strong latitudinal trend of occurrence of steep slopes: even for similar terrain types, steep (greater than 15-20 degrees) slopes are two orders of magnitude less frequent at high latitudes (greater than 40-50 degrees) than at lower latitudes. We have interpreted this as a result of high obliquity periods in the past geological history of Mars: at high obliquity the day-average summer temperature is high and can exceed ice melting point; this favors water-assisted erosion and slope degradation.

Derived from text

Climate; Ejecta; Surface Roughness; Mars Surface; Plains; Statistical Analysis

20050201840 Princeton Univ., NJ, USA

Geology of Lonar Crater, India: An Analog for Martian Impact Craters

Maloof, A. C.; Louzada, K. L.; Stewart, S. T.; Weiss, B. P.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Lonar Crater formed between 15-67 ka in the approximately 65 Ma Deccan Traps of western India. The bolide, of unknown composition, impacted into approximately 600-700 m of subhorizontal basalt flows overlying Precambrian basement. Lonar is a unique Martian analog for studies of ejecta flow dynamics and shock magnetization, as it is the only terrestrial crater formed entirely within basalt. Although sketch maps and paleomagnetic work of variable quality have been published, no detailed geologic map or understanding of shock effects on rock- and paleo-magnetics exist for Lonar Crater. Here we present preliminary geologic and topographic maps, from a January 2005 field study, and identify features for comparison to Martian craters.

Derived from text

Planetary Geology; Mars Craters; Analogs; Mars Surface; Topography

20050201841 Highland High School, Albuquerque, NM, USA

Inverted Martian Craters in Lineated Glacial Valleys, Ismenius Lacus Region, Mars

McConnell, B. S.; Wilt, G. L.; Gillespie, A.; Newsom, H. E.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

We studied small, uniquely-shaped craters found on the surface of lineated terrain in the Ismenius Lacus region of Mars. By utilizing MOC and THEMIS satellite images, we located terrain including lineations (viscous flow features), smoothing of topography, and morphologic features such as polygons and gullies, which appear to be strong evidence of preexisting ice deposits.

Derived from text

Glaciers; Mars Craters; Mars Surface; Valleys

20050201842 Auburn Univ., AL, USA

The Role of Water in Development of the Late Cretaceous Wetumpka Impact Crater, Coastal Plain of Alabama, USA

King, D. T., Jr.; Ormo, J.; Morrow, J. R.; Petruncy, L. W.; Johnson, R. C.; Neathery, T. L.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Wetumpka is a Late Cretaceous marine-target impact structure in the inner Coastal Plain of Alabama. The structure is characterized by a wide, horseshoe-shaped crystalline rim, an interior region of broken and disturbed sedimentary formations, and an extra crater terrain on the south-west composed of structurally disturbed target formations. The extant crater rim spans 270 degrees of arc and is open on the southwest, the same side as the structurally disturbed terrain just noted. The northwest-southeast diameter of the crystalline rim alone is approximately 5 km. In order to understand the influence of target properties on the cratering and modification of Wetumpka, we needed to find its present state of preservation (i.e., where is the erosional

level with regard to an original crater cross section). This was achieved by comparing present geology and topography with standard parameters for impact craters (cf. Melosh), but also incorporating recent results from studies of marine-target craters, especially those strongly affected by the collapse of a thick sequence of poorly consolidated sediments. Studies of marine-target craters such as Chesapeake Bay and Lockne, have brought to light marine-target cratering processes that are also quite evident at Wetumpka. In this paper, we present some new interpretations of this structure in view of this recent information about marine impacts.

Derived from text

Coastal Plains; Water; Alabama; Cretaceous Period; Mars Craters; Planetary Geology

20050201843 Tokyo Univ., Japan

Impact Erosion of Atmospheres: Substantial Atmospheric Loss by Horizontal Atmospheric Excavation

Hamano, K.; Abe, Y.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Mars exhibits geological evidence of past liquid water on its surface. However, the Martian atmosphere today is too cold and thin for liquid water to exist on its surface. How the atmosphere was lost remains unknown. Several mechanisms have been proposed to account for the decrease of the atmospheric amount, such as formation of carbonate and erosion by atmospheric sputtering. Melosh and Vickery suggested impact erosion of the Martian atmosphere. When impact velocity is sufficiently high, the impactor and a part of the planetary surface around the impact point can vaporize and form the impact-induced vapor cloud. The vapor cloud has generally high-pressure that it can accelerate the ambient atmosphere with its expansion. When its energy is sufficiently large, some fraction of the atmosphere can be lost, which is called impact erosion. Melosh and Vickery estimated the impact conditions for the entire atmospheric loss lying above the tangent plane at the impact point, considering the vapor cloud expansion into vacuum. And they indicated that the significant atmospheric loss was caused by impact erosion on Mars through the heavy bombardment. They used a more sophisticated model to estimate the amount of the atmospheric loss more accurately. The vapor cloud and atmosphere are divided into azimuthal sectors, and the momentum balance within a sector is considered. One can compute the critical zenith angle $\theta_{\text{sub esc}}$ that defines the cone-shaped escape region. Although it is harder to blow off the entire atmospheric mass on the tangent plane, the significant atmospheric loss also occurs with the sector model. However, the effect by the stratified atmosphere is ignored. The validity of their models was examined by Newman et al. They showed that a strong shock wave was formed in an atmosphere with the vapor cloud expansion and that the shock propagates quite differently from that assumed in the their models. They insisted that the only the atmosphere just above the vapor cloud would escape, and the amount of the atmospheric loss would be a factor ten less than that by the Vickery and Melosh model. However, they don't calculate the amount of the atmospheric loss and the atmospheric escape region, which is defined as initial position of the atmosphere finally lost from the planet. In this study, we perform numerical simulations using a two-dimensional cylindrical hydrocode and investigate the interactions of the vapor cloud with the planetary atmosphere. The obtained shape of the atmospheric escape region is compared to those by previous works. We also investigate the flow patterns especially around the surface to discuss why the difference in the escape region occurs between the Vickery and Melosh and our study.

Derived from text

Erosion; Impactors; Mars Atmosphere; Planetary Geology; Mathematical Models; Vapors

20050201844 Hawaii Univ., Honolulu, HI, USA

Run-Out Distances of Ejecta Lobes from SLE and MLE Impact Craters on Mars

Mouginis-Mark, Peter J.; Baloga, Stephen M.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

In an effort to gain better insight into the emplacement mechanism of the ejecta for single layered ejecta (SLE) and multiple layered ejecta (MLE) craters on Mars, we are investigating the geometry of the distal ramparts of these craters. Using topographic data from individual orbits of the MOLA instrument, and co-registering these data with 18 m/pixel THEMIS VIS images, we have compiled a data base that includes the run-out distance from the rim crest of the parent crater for many ejecta ramparts. These distances are the extreme values for which rampart heights can be accurately measured. Because many of the ejecta deposits are quite lobate, some craters have segments of deposits that extend slightly farther than the values we obtained. Nevertheless, our data base is suitable for exploring the influence of elevation and latitude on run-out.

Derived from text

Ejecta; Mars Craters; Topography; Distance

20050201845 Planetary Science Inst., Tucson, AZ, USA

Martian Megaregolith Properties: Effects on Launch of SNCs and Secondary Ejecta

Hartmann, W. K.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 1 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Martian megaregolith in Noachian terrains is likely to be deep granular material impregnated with ice and perhaps also weakly bonded by salts and evaporites. Such material is very inefficient in launching solid rocky debris. This is confirmed by observations of Barlow, who shows that fresh 10+ km craters in older upland have fewer secondary craters than similar sized craters in Amazonian lava plains. This is also supported by the theoretical models of Melosh, Pierazzo, and others, who show that coherent rock in the near-surface spallation layer is needed to facilitate launch of high velocity materials. More work is needed on (1) what depths of granular material atop the coherent rock layer inhibits spallation by dissipating energy, and (2) the role of sub surface ice in causing steam blast explosion that may inhibit the launch of rocks. There are many ramifications for Martian meteorite statistics, the production of secondary craters on Mars, the shape of the total production function curve for primaries + secondaries at small diameters, and the use of small craters for surface dating.

Author

Mars Surface; Mathematical Models; Planetary Geology; Regolith; SNC Meteorites; Ejecta

20050201846 Notre Dame Univ., IN, USA

Martian Polar Craters: Possible Polar Materials Apparent Effects and Post-Impact Modification by Apparent Perennial Permafrost Mound (Pingo) Formation

Sakimoto, S. E. H.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

On Mars, as elsewhere, impact craters reveal both target effects as well as postimpact modification processes. The cavity morphology and central peaks or mounds of martian impact craters are key indicators in determining these target properties and processes. The martian polar regions (particularly the northern polar region) display significant departures from the global trends in both crater morphology presumed to be a result of target effects and central deposits presumed to be a result of post-formation processes.

Derived from text

Mars Craters; Mars Surface; Permafrost; Polar Regions; Landforms

20050201847 Lunar and Planetary Inst., Houston, TX, USA

What Do Craters on Icy Satellites Tell Us About Martian Craters?

Schenk, P.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 1 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

It seems obvious that if Martian craters are influenced by subsurface ice, then impacts into natural ice-rich targets should offer some valuable insights into how ice might influence crater development in general. With the Voyager and recent Galileo missions to the Jovian system complete, analysis is underway of crater morphology on the 3 ice-rich Galilean satellites Europa, Ganymede and Callisto. Crater morphology is important on two levels: shape and interior structure, and ejecta. Crater shapes on icy satellites differ radically from those on dry rocky worlds. Complex craters are 60-70% shallower than expected and never exceed 2 km depth. Further, the internal structure of larger craters is dominated by rimmed pits and large domes rather than central peaks or peak rings. Pedestal ejecta facies are the only ejecta morphology on the icy satellites that resembles those found at Martian craters. Pedestals are systematic in dimension and shape, suggesting they are a fundamental part of the ejecta emplacement process on icy bodies. High resolution images show flow lobes (interpreted to be impact melt) draped over parts of the pedestal deposits, but no indications have been found to date that the pedestal itself is emplaced by anything other than 'ballistic emplacement'. Although the largest known impact features on Europa (30-45 km across) probably form in a finite ice layer averaging a substantial fraction of the melting point, it must be remembered that craters on the large Galilean satellites formed at colder temperatures than on Mars. Evidence does suggest that craters on ancient Ganymede are different than those formed today, suggesting they formed in a warmer ice layer than at present. This and the fundamental difference in crater morphology on Europa and Ganymede suggests that the temperature of the ice is important in controlling primary crater morphologies. Another important difference is that the outer zones of the Galilean satellites are dominantly water ice. Unanswered questions relate to how much melt and vapor are produced in warm ice (relative to that produced in colder ice), and how high the ice/rock ratio must be for the rheology and melt behavior of ice to begin influencing crater shape and ejecta formation.

Derived from text

Icy Satellites; Mars Craters; Mars Surface; Geomorphology

20050201848 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Berlin, Germany

Ages and Onset Diameters of Rampart Craters in Equatorial Regions on Mars

Reiss, D.; vanGasselt, S.; Hauber, E.; Michael, G.; Jaumann, R.; Neukum, G.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations

Contract(s)/Grant(s): RTN2-2001-00414; SPP-1115; Copyright; Avail: CASI; [A01](#), Hardcopy

Many large craters on Mars exhibit ejecta blankets which are not observed on other terrestrial planets like the Moon. As found by many researchers the morphology is suggested to be caused by volatile rich target material or atmospheric effects. However, in a given area a certain minimum diameter exists for craters which show fluidized ejecta blankets, called the onset diameter. Geographic mapping shows a latitude dependence of the onset diameters. In equatorial regions the onset diameters are typically 4 to 7 km versus 1 to 2 km in high latitudes (50 latitude), which might indicate a ice rich layer at depths of about 300 to 400 m near the equator and approximately 100 m at 50 latitudes. As pointed out, rampart craters may have formed over a significant time interval and therefore reflect the ground ice depths at a given time. We determined the absolute ages and onset diameters of rampart craters in three equatorial regions on Mars by measuring the ejecta blankets superposed crater frequencies in Mars Express High Resolution Stereo Camera (HRSC) imagery in three equatorial regions.

Derived from text

Equatorial Regions; Mars Surface; Geochronology; Mars Craters

20050201849 Tokyo Univ., Japan

Interaction Between Impact Vapor Clouds and the Early Martian Atmosphere

Sugita, S.a; Schultz, P. H.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Interactions between impact-induced vapor clouds and the ambient planetary atmospheres are considered to have played a very important role in the evolution of planetary atmospheres and surface geology. However, the detailed analysis of such interaction has not been studied extensively before. In this study, we attempt to construct a simple model of vapor atmosphere interactions taking into account the effects of both fluid dynamics and chemical reactions.

Derived from text

Mars Atmosphere; Planetary Evolution; Vapors; Planetary Geology; Hypervelocity Impact

20050201850 Harvard Univ., MA, USA

Field Observations of Ground-hugging Ejecta Flow at Lonar Crater, India

Stewart, S. T.; Louzada, K. L.; Maloof, A. C.; Newsom, H. E.; Weiss, B. P.; Wright, S. P.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

One of the least understood aspects of impact cratering are the processes governing ejecta emplacement. This is due, in part, to the lack of preservation of ejecta at almost all terrestrial impact structures, which are usually subject to extensive postimpact erosive processes. Hence, much of our knowledge of ejection processes is derived from laboratory experiments and explosion craters and studies of lunar craters. These studies led to the model of ballistic sedimentation, where the dominant process is ballistic ejection of primary materials from the crater cavity and incorporation of secondary materials upon impact onto the surrounding surface. However, the best studied ejecta blankets around terrestrial craters (Meteor Crater and the Ries and Chicxulub impact structures) record much more complicated ejecta dynamics and a component of ground-hugging flow. The prevalence of layered ejecta morphologies on Mars, where the continuous ejecta blanket extends greater than approximately 1.5 times farther compared to fresh lunar craters, suggests that similar processes may affect ejecta emplacement on Earth and Mars that are distinct from the Moon. Suggested mechanisms include the presence of an atmosphere, the presence of volatiles (liquid water or ice), and the nature of sedimentary lithologies. In January 2005, we conducted a field study of Lonar Crater, India, and found compelling evidence for ground hugging ejecta flows following the initial ballistic ejection episode, similar to ejecta flows on Mars.

Derived from text

Ejecta; Lunar Craters; India

20050201851 Tokyo Univ., Japan

Investigating Surface Scouring Processes and Ejecta Deposition by Impact Generated Winds

Suzuki, A.; Barnouin-Jha, O. S.; Kumagai, I.; Nagata, Y.; Kurita, K.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

The Martian atmosphere and subsurface volatiles could both contribute to the formation of fluidized ejecta on Mars. In this study, we investigate the late stages of ejecta deposition and surface scour by atmospheric winds generated during an impact. We focus on both the mechanics of surface scour as well as transport of material generated by strong winds generated from an impact. We will emphasize both the formation of surface lineations in order to address their existence on pedestal craters (recently also called double layered ejecta (DLE) craters), and the mechanics of how such winds generate ground-hugging surface gravity currents. We consider only the very late stages of ejecta emplacement, when a ring vortex produced by an ejecta curtain advancing into an atmosphere becomes decoupled from the curtain to strike and erode the target surface. We decouple this vortex from the ballistic ejecta curtain by conducting experiments in a water tank, examining the interaction between a vortex ring and a layer of surface particles. Our results indicate that even present Martian conditions are sufficient to form surface lineations seen on fluidized ejecta of pedestal craters. These experiments also show that gravity flows resulting from plumes of particulates uplifted by the vortex ring help generate the fluidized appearance of ejecta when deposited by an atmosphere.

Author

Ejecta; Mars Atmosphere; Wind (Meteorology); Mars Surface

20050201852 California Inst. of Tech., Pasadena, CA, USA

Viscous Relaxation of Secondary Craters Within the Martian South Polar Layered Deposits

Pathare, A. V.; Schaller, E. L.; Murray, B. C.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 86-87; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Schaller et al. [1] examined the morphologies of the secondary crater fields of two large impacts on the South Polar Layered Deposits (SPLD): McMurdo crater at 84.5degS, 0degW and an un- named impact (hence 'Crater II') at 80.8degS, 284degW. They found a complete lack of secondary craters smaller than 300 meters in diameter in both crater fields, which implies that at least the upper 30 meters of the SPLD has been resurfaced since the time of these impacts. Moreover, SPLD secondary crater depth-to-diameter ratios are very low, with an average value of $d/D = 0.016$ [1], which is much less than the $d/D = 0.11$ characteristic of fresh lunar and Martian secondaries [2].

Derived from text

Planetary Geology; Mars Surface; Mars Craters; Deposits

20050201853 Hawaii Univ., Honolulu, HI, USA

Martian Craters Viewed by the THEMIS Instrument: Double-layered Ejecta Craters

Boyce, Joseph M.; Mouginis-Mark, Peter J.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

A global search of THEMIS VIS data (18 m/pixel) allows the identification of 89 fresh appearing double layer ejecta DLE craters in the diameter range 5.5 to 29.6 km. Most of these craters occur in two latitudinal bands, from 28.9deg to 51.53degS, and 23.3deg to 57.3degN, and at elevations from -6.0 to +2.0 km relative to Mars datum, confirming observations [1] that DLE craters occur at/on a variety of elevations, terrain types and terrain ages on Mars (Fig. 1).

Author

Mars Craters; Planetary Geology; Mars Surface; Pixels; Ejecta

20050201854 Lawrence Livermore National Lab., Livermore, CA, USA

Nuclear Cratering Experience in the US. and Russia

Nordyke, Milo D.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 1 pp.; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

From 1960 to the mid-70s, both the U.S. and Russia carried out a number of nuclear cratering experiments as well as an array of low-yield high explosive cratering tests in a variety of geologic environments which provided useful data on understanding the mechanics of terrestrial explosive cratering. Whereas the majority of U.S. nuclear cratering experiments were in relatively dry unsaturated environments, the Russian tests were in relatively high moisture content or saturated conditions. The results show that larger craters were formed initially, followed by varying degrees of slope failure resulting from the saturated conditions and readjustment of the crater slopes. However, comparison of the data shows a good correlation when the differences in the geologic conditions are considered. Of special interest to studies of meteoritic craters may be the

large yield craters in the saturated coral of Bikini and Enewetak Atolls and the development of numerical tools for predicting the effect of the water saturated and other more unstable environment.

Author

Russian Federation; United States; Meteorite Craters; Planetary Geology

20050201856 NASA Ames Research Center, Moffett Field, CA, USA

Distribution and Orientation of Alluvial Fans in Martian Craters

Kraal, E. R.; Moore, J. M.; Howard, A. D.; Asphaug, E. I.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

We present the results of the complete survey of Martian alluvial fans from 0-30 S, initiated by Moore and Howard. Nineteen impact craters contain alluvial fans. They are regionally grouped into three distinct areas. We present our initial results regarding their distribution and orientation in order to understand what controls their formation. Since alluvial fans are formed by water transport of sediment, these features record wetter episodes of Martian climate. In addition, their enigmatic distribution (in regional groups and in some craters, but not similar adjacent ones) needs to be understood, to see how regional geology, topographic characteristics, and/or climate influence their formation and distribution.

Author

Alluvium; Mars Craters; Mars Surface; Planetary Geology

20050201858 Museum fuer Naturkunde, Berlin, Germany

Impact Craters on Mars and Earth: Implications by Analogy

Kenkmann, T.; Schoenian, F.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 57-58; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

This paper reports on recent investigations on terrestrial impact structures, which may have relevance for understanding Martian impact craters and the role of volatiles during their formation. It focuses on the properties of the ejecta blankets of the Chicxulub and Ries crater. Implications by analogy between Earth and Mars craters support the view that the formation of fluidized ejecta blankets can be linked to the presence of subsurface volatile reservoirs (water or ice) [1, 2]. The role of atmospheric effects [3] for the deposition of ejecta blankets on Earth is currently not clear.

Derived from text

Mars Surface; Mars Craters; Ejecta; Atmospheric Effects

20050201859 Harvard Univ., Cambridge, MA, USA

Post-Shock Temperature Measurements of Basalt: Improving the Basalt Equation of State and Modeling of Post-Impact Conditions

Kennedy, G. B.; Stewart, S. T.; Senft, L. E.; Obst, A. W.; Furlanetto, M. R.; Payton, J. R.; Seifert, A.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Direct measurements of post-shock temperatures of rocks and minerals provide strong constraints on their equations of state, the temperature field surrounding fresh impact craters, and the thermal history of meteorites. Multi-wavelength temperature measurements also furnish insights into temperature variations due to porosity and material mixtures. Here we present preliminary results from simultaneous measurements of particle velocity and free surface emission from shocked Columbia River flood basalt and comparisons to simulations using the shock physics code CTH.

Derived from text

Basalt; Equations of State; Temperature Measurement; Models; Shock Waves; Mars Surface

20050201860 NASA Goddard Space Flight Center, MD, USA, Harvard Univ., Cambridge, MA, USA

Impact Crater Geometries Provide Evidence for Ice-rich Layers at Low Latitudes on Mars

Black, B. A.; Stewart, S. T.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 25-26; In English; See also 20050201815; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-13474; Copyright; Avail: CASI; [A01](#), Hardcopy

The impact cratering record documents the history of resurfacing events on Mars. The morphology and distribution of layered (rampart) ejecta blankets provide insights into the presence of volatiles in the upper crust [1-4]. The physical properties of the crust and history of water have been revealed through recent quantitative studies of the geometry of Martian craters

[5-91]. Here, we present the results from a study focused on impact craters in Utopia Planitia and the Elysium Mons province to infer the history and properties of resurfacing episodes.

Author

Mars Craters; Morphology; Crusts; Cratering; Ice

20050201861 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Exploration Rover Field Observations of Impact Craters at Gusev Crater and Meridiani Planum and Implications for Climate Change

Golombek, M.; Grant, J. A.; Crumpler, L. S.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 40-41; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

The Mars Exploration Rovers have provided a field geologist's perspective of impact craters in various states of degradation along their traverses at Gusev crater and Meridiani Planum. This abstract will describe the craters observed and changes to the craters that constrain the erosion rates and the climate [1]. Changes to craters on the plains of Gusev argue for a dry and desiccating environment since the Late Hesperian in contrast to the wet and likely warm environment in the Late Noachian at Meridiani in which the sulfate evaporites were deposited in salt-water playas or sabkhas.

Derived from text

Roving Vehicles; Mars Craters; Climate Change; Mineral Deposits; Mars Surface; Mars Landing Sites; Geology; Erosion

20050201862 Academy of Sciences (Russia), Moscow, Russia

Impact Cratering and Material Models: Subsurface Volatiles on Mars

Ivanov, B. A.; Artemieva, N. A.; Pierazzo, E.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 55-56; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

Besides Earth, Mars is the only planet that shows presence of subsurface water/ice/brine. Volatiles change the properties of crustal rocks and affect the impact crater formation process. Spatial and temporal variations of volatiles phase state in the Martian crust make impact crater morphology a valuable tool to obtain insights into crust mechanical properties. However, much work must still be done to translate cratering data into water/ice content and its variation with depth.

Derived from text

Mars Surface; Atmospheric Composition; Moisture Content; Spatial Distribution; Planetary Geology; Planetary Crusts

20050201863 Smithsonian Institution, Washington, DC, USA

Rim Breaching and Ponding in Martian Impact Craters

Irwin III, R. P.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 53-54; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Many degraded impact craters and intercrater basins received drainage from valley networks on early Mars, but the Occurrence of paleolakes in most of these basins remains uncertain. Deltas are rare, and the lithology and stratigraphy of most of the low-gradient basin plains are unknown. However, the geomorphic context, topographic setting, and morphology of these breached craters offer insight into an ephemeral fluvial/lacustrine system.

Derived from text

Structural Basins; Planetary Craters; Drainage; Lithology; Mars Craters; Mars Surface

20050201864 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Characteristics of Impact Craters and Interior Deposits: Analysis of the Spatial and Temporal Distribution of Volatiles in the Highlands of Mars

Mest, S. C.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005], pp. 77-78; In English; See also 20050201815; Copyright; Avail: CASI; [A01](#), Hardcopy

The martian southern highlands contain impact craters that display pristine to degraded morphologies, and preserve a record of degradation that can be attributed to fluvial, eolian, mass wasting, volcanic and impact-related processes. However, the relative degree of modification by these processes and the amounts of material contributed to crater interiors are not well constrained. Impact craters (D>10 km) within Terra Cimmeria (0deg-60degS, 190deg-240degW), Terra Tyrrenna (0deg-30degS, 260deg-310degW) and Noachis Terra (20deg-50degS, 310deg-340degW) are being examined to better understand the degradational history and evolution of highland terrains. The following scientific objectives will be accomplished. 1) Determine the geologic processes that modified impact craters (and surrounding highland terrains). 2) Determine the sources (e.g. fluvial, lacustrine, eolian, mass wasting, volcanic, impact melt) and relative amounts of material composing crater interior

deposits. 3) Document the relationships between impact crater degradation and highland fluvial systems. 4) Determine the spatial and temporal relationships between degradational processes on local and regional scales. And 5) develop models of impact crater (and highland) degradation that can be applied to these and other areas of the martian highlands. The results of this study will be used to constrain the geologic, hydrologic and climatic evolution of Mars and identify environments in which subsurface water might be present or evidence for biologic activity might be preserved.

Author

Mars Craters; Mars (Planet); Highlands; Mars Surface; Deposits; Spatial Distribution; Temporal Distribution

20050201865 Alaska Univ., Fairbanks, AK, USA

Inferences from Oblique Impact Craters About the Role of the Atmosphere and Subsurface Volatiles in the Impact Cratering Process on Mars

Herrick, R. R.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Comparison of the ejecta blankets from Martian low-angle impact craters with those on Venus, the moon, and from small-scale experiments suggests that the Martian ejecta are emplaced ballistically and then flow due to the presence of volatiles within the ejecta blanket.

Derived from text

Mars Surface; Mars Craters; Obliqueness; Volatility; Mars Atmosphere

20050201866 Tennessee Univ., Knoxville, TN, USA

Evidence for the Role of Sub-surface Volatiles in the Formation of Large Rayed Crater Systems on Mars: Implications for the Ejection of the Martian Meteorites

Tornabene, L. L.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Five definitive and three probable large rayed crater systems have been discovered on Mars using thermal infrared (TIR) images from the Thermal Emission Imaging System (THEMIS - 100m/pixel) and visible images from THEMIS (approx.18m/pixel) and narrow-angle Mars Orbiter Camera (MOC) images (several meters per pixel)[1, 2]. Morphological characteristics (e.g. apparent youth, crater diameter, oblique impact origin, fluidized ejecta, etc.) and a geographic bias to predominately young volcanic plains for rayed craters are all strong links to the proposed characteristics of the Martian Meteorite (MMs) source region [1], which is based on geochemical ages (i.e. crystallization and ejection) and characteristics of the MMs [3]. Here we present evidence in the form of visible image observations and from the most recent MM delivery a model that implicates subsurface volatiles may have played a positive role in the formation of rays and increased spallation volumes for the delivery of the MMs.

Derived from text

SNC Meteorites; Craters; Ejecta; Geochemistry; Pixels; Ejection; Imaging Techniques; Infrared Imagery

20050201867 Brown Univ., Providence, RI, USA

Effects of an Early-Time Impact Generated Vapor Blast in the Martian Atmosphere: Formation of High-Latitude Pedestal Craters

Wrobel, K. E.; Schultz, P. H.; Crawford, D. A.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG5-11538; Copyright; Avail: CASI; [A01](#), Hardcopy

Following impact, vapor expansion creates an intense airblast that interacts with the ambient atmosphere. The resulting hemi-spherical shock wave leaves a signature on the surface that is dependent on initial atmospheric and surface conditions. Here we propose that the formation of pedestal craters (craters surrounded by an erosion-resistant pedestal) may be a direct consequence of extreme winds and elevated temperatures generated by such an impact-induced atmospheric blast. Pedestal craters, first recognized in Mariner 9 data, are a unique feature on Mars and likely a signature of near-surface volatiles. They are found at high latitudes (small pedestals, Amazonian to Late Hesperian in age) and in thick equatorial mantling deposits (larger pedestals, early Hesperian to Noachian in age). Previously suggested mechanisms for pedestal crater formation (e.g., wind: ejecta curtain vortices or vapor blast; and ejecta dust: armoring) do not provide a complete picture. The clear evidence for near-surface volatiles at high latitudes requires a re-evaluation of these alternative models. The results presented here

suggest that a combined atmospheric blast/thermal model provides a plausible formation hypothesis.

Derived from text

Vapors; Mars Atmosphere; Mars Craters; Polar Regions; Shock Waves; Hypervelocity Impact

20050201868 New Mexico Univ., Albuquerque, NM, USA

Hydrothermal Processes and Mobile Element Transport in Martian Impact Craters - Evidence from Terrestrial Analogue Craters

Newsom, H. E.; Nelson, M. J.; Shearer, C. K.; Dressler, B. L.; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color illustrations

Contract(s)/Grant(s): NAG5-10143; Copyright; Avail: CASI; [A01](#), Hardcopy

Hydrothermal alteration and chemical transport involving impact craters probably occurred on Mars throughout its history. Our studies of alteration products and mobile element transport in ejecta blanket and drill core samples from impact craters show that these processes may have contributed to the surface composition of Mars. Recent work on the Chicxulub Yaxcopoil-1 drill core has provided important information on the relative mobility of many elements that may be relevant to Mars. The Chicxulub impact structure in the Yucatan Peninsula of Mexico and offshore in the Gulf of Mexico is one of the largest impact craters identified on the Earth, has a diameter of 180-200 km, and is associated with the mass extinctions at the K/T boundary. The Yax-1 hole was drilled in 2001 and 2002 on the Yaxcopoil hacienda near Merida on the Yucatan Peninsula. Yax-1 is located just outside of the transient cavity, which explains some of the unusual characteristics of the core stratigraphy. No typical impact melt sheet was encountered in the hole and most of the Yax-1 impactites are breccias. In particular, the impact melt and breccias are only 100 m thick which is surprising taking into account the considerably thicker breccia accumulations towards the center of the structure and farther outside the transient crater encountered by other drill holes.

Derived from text

Mars Craters; Mars Surface; Planetary Geology; Hydrothermal Systems; Analogs

20050201869 Geological Survey, Reston, VA, USA

Chesapeake Bay Impact Structure: Morphology, Crater Fill, and Relevance for Impact Processes on Mars

Horton, J. Wright, Jr.; Powers, David S.; Gohn, Gregory S.; Ormo, Jens; Workshop on The Role of Volatile and Atmospheres on Martian Impact Craters; [2005]; 2 pp.; In English; See also 20050201815; Original contains color and black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

The late Eocene Chesapeake Bay impact structure (CBIS) on the Atlantic margin of Virginia may be Earth's best preserved large impact crater formed in a shallow marine, siliciclastic, continental shelf environment. This complex crater has special features that may be useful analogs for features of layered-target or wet-target craters on Mars. The CBIS formed in a layered target of water (maximum depth 340 m), weak clastic sediments (400 to greater than 750 m thick), and crystalline rock. It is well preserved beneath approximately 150 to 400 m of postimpact sediments. The buried structure has the form of an inverted sombrero in which a central crater (approximately 38 km wide, approximately 1.6 km deep) in the crystalline basement and overlying sediments is surrounded by a flat-floored brim known as the annular trough (approximately 85-km wide). The central crater has a relatively steep outer margin, and it contains an elliptical moat that encircles a broad central uplift. The annular trough is a prominent feature of the CBIS, and it formed by the extensive collapse of thick, poorly consolidated sediments. The collapse expanded the structure to a diameter far exceeding the transient cavity, likely better expressed by the nested central crater. Large-scale block slumping of sediments along numerous small-displacement faults in the annular trough resembles slumping in the chaotic terrains on Mars. Martian chaotic terrains may have formed by fluidization of stratified material due to catastrophic melting of ground ice and rapid dissociation of clathrates. Seismic profiles across the annular trough suggest that extensional collapse structures (0.5 to 3.9 km wide) are concentrated in structural rings that partly coincide with impact-generated compressional structures in the basement. These concentric collapse structures also coincide with the zones of greatest postimpact subsidence in the annular trough.

Derived from text

Chesapeake Bay (US); Planetary Geology; Mars Surface; Mars Craters; Seismology; Geomorphology

20050201911 NASA Goddard Space Flight Center, Greenbelt, MD, USA

In situ Analysis of Organic Compounds on Mars using Chemical Derivatization and Gas Chromatography Mass Spectrometry

Glavin, D. P.; Buch, A.; Cabane, M.; Coll, P.; Navarro-Gonzalez, R.; Mahaffy, P. R.; [2005]; 2 pp.; In English; NASA

Astrobiology Institute Meeting, 10-14 Apr. 2005, Boulder, CO, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

One of the core science objectives of NASA's 2009 Mars Science Laboratory (MSL) mission is to determine the past or present habitability of Mars. The search for key organic compounds relevant to terrestrial life will be an important part of that assessment. We have developed a protocol for the analysis of amino acids and carboxylic acids in Mars analogue materials using gas chromatography mass spectrometry (GCMS). As shown, a variety of carboxylic acids were readily identified in soil collected from the Atacama Desert in Chile at part-per-billion levels by GCMS after extraction and chemical derivatization using the reagent N,N-tert.-butyl (dimethylsilyl) trifluoroacetamide (MTBSTFA). Several derivatized amino acids including glycine and alanine were also detected by GCMS in the Atacama soil at lower concentrations (chromatogram not shown). Lacking derivatization capability, the Viking pyrolysis GCMS instruments could not have detected amino acids and carboxylic acids, since these non-volatile compounds require chemical transformation into volatile species that are stable in a GC column. We are currently optimizing the chemical extraction and derivatization technique for in situ GCMS analysis on Mars. Laboratory results of analyses of Atacama Desert samples and other Mars analogue materials using this protocol will be presented.

Author

Mars Missions; Organic Compounds; Gas Chromatography; Mass Spectroscopy; Chemical Analysis

20050201932 Lawrence Livermore National Lab., Livermore, CA USA

Simulations of Turbulence Induced Ellipticity Over Large Fields of View: The First Step Towards Enabling LSST Weak Lensing Science

Schlaufman, K.; Nov. 05, 2004; 14 pp.; In English

Report No.(s): DE2005-15014580; UCRL-TR-207730; No Copyright; Avail: Department of Energy Information Bridge

Atmospheric turbulence can mimic the effects of weak lensing in astronomical images, so it is necessary to understand to what degree turbulence effects weak lensing measurements. In particular, we studied the ellipticity induced upon the point-spread functions (PSFs) of a grid of simulated stars separated by distances that will be characteristic of Large Synoptic Survey Telescope (LSST) images. We observe that atmospherically induced ellipticity changes on small scales and use linear interpolation between stars separated by scales to determine the induced ellipticity everywhere in the field-of-view.

NTIS

Atmospheric Turbulence; Ellipticity; Gravitational Lenses; Simulation; Turbulence

20050202028 Louisiana State Univ., Baton Rouge, LA, USA

Effective Crew Operations: An Analysis of Technologies for Improving Crew Activities and Medical Procedures

Harvey, Craig; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 9-1 - 9-9; In English;

See also 20050202011; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1526; NNJ04JF93A; No Copyright; Avail: CASI; A02, Hardcopy

NASA's vision for space exploration (February 2004) calls for development of a new crew exploration vehicle, sustained lunar operations, and human exploration of Mars. To meet the challenges of planned sustained operations as well as the limited communications between Earth and the crew (e.g., Mars exploration), many systems will require crews to operate in an autonomous environment. It has been estimated that once every 2.4 years a major medical issue will occur while in space. NASA's future travels, especially to Mars, will begin to push this timeframe. Therefore, now is the time for investigating technologies and systems that will support crews in these environments. Therefore, this summer two studies were conducted to evaluate the technology and systems that may be used by crews in future missions. The first study evaluated three commercial Indoor Positioning Systems (IPS) (Versus, Ekahau, and Radianse) that can track equipment and people within a facility. While similar to Global Positioning Systems (GPS), the specific technology used is different. Several conclusions can be drawn from the evaluation conducted, but in summary it is clear that none of the systems provides a complete solution in meeting the tracking and technology integration requirements of NASA. From a functional performance (e.g., system meets user needs) evaluation perspective, Versus performed fairly well on all performance measures as compared to Ekahau and Radianse. However, the system only provides tracking at the room level. Thus, Versus does not provide the level of fidelity required for tracking assets or people for NASA requirements. From an engineering implementation perspective, Ekahau is far simpler to implement than the other two systems because of its wi-fi design (e.g., no required runs of cable). By looking at these two perspectives, one finds there was no clear system that met NASA requirements. Thus it would be premature to suggest that any of these systems are ready for implementation and further study is required.

Author

Space Exploration; Mars Exploration; Lunar Exploration; Systems Analysis; User Requirements; Spacecrews

20050202046 Southwest Research Inst., Boulder, CO, USA

On the Formation Location of Asteroids and Meteorites

Bottke, W. F.; Nesvorný, D.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Despite the advances made by the planetary science community over the last several decades, there are still fundamental questions about the origin and evolution of asteroids and meteorites. Here we concentrate on the iron meteorites, which currently dominate the fraction of distinct parent bodies represented in our meteorite collection (i.e., 27 chondritic, 2 primitive achondritic, 6 differentiated achondritic, 4 stony-iron, 10 iron groups, and 50 ungrouped irons; Meibom and Clark 1999; Burbine et al. 2002). Chemical and petrographic evidence indicates nearly all iron meteorites came from the cores of distinct differentiated asteroids; they cannot be explained away as impact melts or as fragments produced by the disruption of a few large differentiated bodies like D=530 km asteroid (4) Vesta. Moreover, cooling rate and textural data suggests that many iron meteorites came from small parent bodies (e.g., 20 less than D less than 400 km; Mittlefehldt et al. 1998). Collectively, we infer from these constraints that differentiated asteroids and the geologic processes that formed them were once common in the solar system.

Derived from text

Asteroids; Chondrites; Iron Isotopes; Stony-Iron Meteorites

20050202047 Chicago Univ., Chicago, IL, USA

Correlation Between Chemical and Oxygen Isotopic Compositions in Chondrites

Clayton, Robert N.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Although there is growing support for the role of isotopic self-shielding in the photolysis of gaseous carbon monoxide as the main process leading to the 'anomalous' isotopic fractionation of oxygen in the early solar system, there is no consensus concerning the physical site of this process. Many recent SIMS studies of refractory inclusions (CAIs) and chondrules have elucidated the mineralogical, chemical, and spatial systematics, which may provide constraints on P,T conditions and timescales for condensation, melting, evaporation, and alteration processes. It is well-established that the primary formation of CAIs involved condensation from a gas of solar chemical and oxygen isotopic composition. An O-16-rich solar isotopic composition, with (δ O-18 and (δ O-17 both near - 50‰ relative to SMOW, is implied from the meteorite data, and from solar atoms implanted in lunar soil grains. Primary condensates were subsequently altered isotopically by exchange with a gas, probably H₂O or atomic O, which had been enriched in O-17 and O-18 by the photochemical process. A clue to the conditions of this secondary process may come from correlations of oxygen isotope abundances with chemical properties related to oxidation reactions, such as the ferrous iron content of chondritic silicates.

Derived from text

Isotopic Labeling; Oxygen 17; Oxygen 18; Composition (Property); Chondrites; Meteoritic Composition

20050202050 Arizona Univ., Tucson, AZ, USA

Exploring the Origin of Planetary Water Using an Atomistic Approach

Stimpf, M.; Drake, M. J.; Lauretta, D. S.; Demyer, D. S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

The origin of Earth's water and, by extension, water in other inner solar system bodies has been long debated. Two main scenarios have been proposed to account for the delivery of water to the inner planets: either the water originated outside of the inner solar system and was later delivered to the terrestrial planets or the source of water was local and was concomitantly accreted to the accreting bodies. Isotopical and geochemical fingerprints seem to indicate that comets and asteroids alone could not have been the principal source of water for the Earth. Furthermore, these exogenous sources of water would have delivered the water, after the planet had reached more than 85% of its size, after core formation. However, such late delivery of water seems to be in contrast with geochemical requirements. If the Earth acquired its water locally, this source of water could be represented by hydrous material that formed at 1 AU. Under this scenario, hydrous material was incorporated directly into the accreting Earth early on, thus influencing the geochemical behavior of elements partitioning between the mantle and the core, the oxidation state of the mantle, and also keeping the surface of the planet at a T high enough to sustain a magma ocean. However, most models of the solar nebula do not allow stable hydrous minerals at 1 AU. We explore the role of adsorption onto grains prior to planetary accretion as a possible new mechanism that could bring water to the Earth. Monte Carlo simulation of adsorption at nebular T, P and fH₂O onto a flat surface showed that this mechanism can store on dust grains in the pre-accretion disk up to 3 times the Earth's oceans. This model, however, did not take into account the specific surface interactions between water gas and the crystalline surface nor did it investigate rigorously the role of porosity. To fill this gap,

we are performing molecular dynamics simulation of the system water and olivine using the code GULP. The bulk olivine will be modelled using periodic boundary conditions (PBC) and Buckingham potentials for the short-range interactions with a cut off distance of 10 Angstroms for both short and long range interactions. The virtual crystal was then cleaved by removing the PBC in the positive z direction and thus creating a free surface. After the top layer relaxed we inserted water molecules and studied their trajectories. This simulation will allow construction of surface site adsorption probabilities and site energies at nebular T.

Author

Water; Earth Surface; Geochemistry; Molecular Dynamics

20050202053 New Mexico Univ., Albuquerque, NM, USA

Effect of In-Situ Aqueous Alteration on Thermal Model Heat Budgets

Cohen, B. A.; Coker, R. F.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

CM chondrites experienced relatively low-temperature aqueous alteration, at least some of which happened on their parent body. The conditions under which aqueous alteration occurred are: fluid temperatures of 0-25C, from the time of asteroid formation up to 15 Myr and mobility over scales of only tens of microns. Conclusions: Hydration prior to final parent body formation and evolution is insufficient, in itself, to resolve the mismatch between thermal models and CM meteorite observations. Ongoing simulations are exploring parameters such as macroporosity and kinetics of heat release. Asteroid thermal models have been successful in describing high-temperature parent-body processing, but no models yet completely characterize CMtype parent bodies. We continue to use our thermal model, which addresses the characteristics and physics of the liquid water phase, to develop scenarios that produce liquid water consistent with observed thermal and spatial constraints in CM meteorites.

Derived from text

Asteroids; Chondrites; Heat Transfer

20050202054 Rutgers Univ., Piscataway, NJ, USA

High Temperature Effects Including Oxygen Fugacity, in Pre-Planetary and Planetary Meteorites and Asteroids

Delaney, Jeremy S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

The properties of asteroids are established by early solar system accretion processes. The elemental and isotopic compositions of a meteorite, and by extension its parent body, reflect the composition of the nonvolatile nebular components available at the time of assembly. The chemical state of the elements, in contrast, is a reflection of both these condensable components and, provides a proxy for volatile components such as H₂, H₂O, CO, CO₂, CH₄, SO₂, that are not usually present in the available samples. High temperature processes produce the gross properties of both pre-planetary and planetary asteroids. Pre-planetary asteroids that have not experienced planetary differentiation are more abundant than the fully differentiated planetary asteroids. Pre-planetary asteroids are most closely associated with chondritic meteorites of various types. Planetary asteroids, or planetoids, are represented by achondrite groups. All stages from zero differentiation, through intermediate states, to complete differentiation, are represented by meteorites.

Derived from text

Asteroids; High Temperature; Oxygen; Temperature Effects; Meteoritic Composition

20050202055 Arizona Univ., Tucson, AZ, USA

Oxygen Fugacity Variations Within and Among Meteorite Parent Bodies

Lauretta, Dante S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Meteorites consist essentially of the silicate minerals olivine and pyroxene, iron-nickel alloys, sulfide minerals, and an enormous variety of accessory minerals. Most meteorites originate from the asteroid belt. The geologic diversity of asteroids and other rocky bodies of the solar system are displayed in the enormous variety of textures and mineralogies observed in meteorites.

Derived from text

Oxygen; Iron Alloys; Meteorites; Olivine

20050202056 Open Univ., Milton Keynes, UK

Oxygen Isotopic Variation of Asteroidal Materials

Franchi, I. A.; Greenwood, R. C.; Baker, L.; Morris, A. A.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

The vast meteorite collections now available reveal a fantastically diverse range of different rock types and minerals that originate from asteroids. This suite contains minerals that have existed prior to the formation of the Solar System, grains which formed from the gas and dust of the solar nebula and minerals that are the result of secondary process once these early formed grains, together with ices, had accreted onto planetesimals. As such these rocks and minerals record a large range in oxygen isotopic compositions, reflecting the location, sources and conditions of their formation. This offers an important tool in tracking the origin and evolution of asteroidal and planetary material. Differential incorporation of these components into the planetesimals has led to oxygen isotopic variations persisting at all scales, even measurable isotopic variations between a large number of asteroids and planets. As such, oxygen isotopic measurements are a useful tool in the determining the relationships between randomly collected and diverse meteorites. However, this is only possible as we develop our understanding of the isotopic variation within individual asteroids and the internal processes which modify the oxygen isotopic signatures.

Derived from text

Oxygen Isotopes; Asteroids; Isotopic Labeling; Protoplanets

20050202057 New Mexico Univ., Albuquerque, NM, USA

Comparative Planetary Mineralogy: V Systematics in Planetary Pyroxenes and fO₂ Estimates for Basalts from Vesta

Karner, J. M.; Papike, J. J.; Shearer, C. K.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

As part of the Lunar and Planetary Institute's Oxygen in the Solar System initiative, we have been developing V valence oxybarometers (VVOs), as measured in basaltic phases. Vanadium can exist as V(2+), V(3+), V(4+), and V(5+), and thus VVOs record at least 8 orders of magnitude of fO₂, and are especially applicable to reduced planetary materials. Our first V work concentrated on basaltic glasses, but now we are developing VVOs for chromite, olivine and pyroxene. A VVO for pyroxene will be particularly useful for the study of basalts from asteroids (i.e. eucrites), and from Mars, in which pyroxene is an early crystallizing phase. This study explores the behavior of V in pyroxenes from planetary basalts and estimates the fO₂ of basalts from 4 Vesta.

Author

Basalt; Planetary Composition; Pyroxenes; Mineralogy; Vesta Asteroid; Vanadium

20050202059 Massachusetts Inst. of Tech., Cambridge, MA, USA

OH and H₂O on Asteroids: An Astronomical Perspective

Rivkin, A. S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

The vast majority of meteorite parent bodies are thought to reside in the asteroid belt. In addition to the known samples in the collections, there is a large amount of unsampled material among the asteroids. Because of the current impracticability of sampling a large number of asteroids via space mission, remote sensing techniques have been developed to determine asteroidal compositions from ground-based (and occasionally space-based) observations. In the 35 years since the first modern asteroid spectra were published, a large amount of data have been collected, which provide us with direct and/or indirect evidence of the presence of phyllosilicates, oxidized and reduced forms of iron, pyroxene and olivine, troilite, and other minerals on asteroidal surfaces. I will address what these observations tell us about the oxygen distribution and low-temperature processes in the asteroid belt, focusing on what we've learned about hydroxyl/water-bearing minerals, but also touching on other relevant data as appropriate.

Author

Water; Hydroxyl Radicals; Asteroids; Meteorites

20050202060 Arizona State Univ., Tempe, AZ, USA

Competitive Oxidation and Hydration During Aqueous Alteration of Asteroids

Zolotov, M. Y.; Mironenko, M. V.; Shock, E. L.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: Studies of chondrites show that incorporation of H₂O ice during formation of asteroids followed by radioactive heating caused partial oxidation and hydration of primary reduced and anhydrous rocks. Oxidation of kamacite,

phosphides, troilite and organic polymers occurred through consumption of water's oxygen and release of H₂. Hydration caused formation of serpentine, saponite, chlorite, talc and hydrated salts. Since H₂O was the major reactant in oxidation and hydration, these processes could have been competitive. Redox reactions in asteroids should have been closely connected to hydration (dehydration) during aqueous alteration and thermal metamorphism. For example, dehydration and reduction release H₂O that can be consumed in oxidation and hydration, respectively. We model asteroidal processes in order to quantify the fate of H₂O and water's oxygen in major redox and hydration/dehydration reactions. Model: Equilibrium compositions in the gas-solid-liquid

Author

Oxidation-Reduction Reactions; Hydration; Asteroids; Water; Ice; Planetary Evolution

20050202062 Arecibo Ionospheric Observatory, Arecibo, Puerto Rico

Water Distribution in the Asteroid Belt

Howell, E. S.; Rivkin, A. S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Water is abundant in the solar system, reactive, and a sensitive thermal tracer in asteroids. We learn a great deal about the formation conditions and thermal history of asteroids by measuring where the water is and is not. Water ice was presumably incorporated into at least the middle and outer belt asteroids. If these objects were heated, melting the ice, the water would quickly react with any silicate minerals forming phyllosilicates, containing structural hydroxyl groups and possibly also interlayer water molecules. We see the spectral signatures of these hydrated minerals in the reflectance spectrum of asteroids at 3 microns. The 3micron absorption feature is a very useful diagnostic spectral feature on asteroids. It has been suggested that the 3micron band could be produced by effects unrelated to water/OH, but all of the alternative interpretations proposed make predictions that are not supported by the observations. In spite of improved infrared instrumentation, it remains difficult to observe the 3micron band from the ground because of strong atmospheric absorption. Another spectral feature that is easier to observe, and can be detected by smaller telescopes on fainter objects, is the 0.7 micron phyllosilicate feature. This absorption band is a Fe²⁺ Fe³⁺ charge transfer band in iron-bearing phyllosilicates. Although there is clearly a correlation between the 0.7 and 3micron features, there are inconsistencies as well. Hiroi et al. (1996) showed that mild heating subsequent to aqueous alteration can explain objects that have the 3micron feature but not the 0.7 feature. However, the 0.7micron feature should never be present without the 3micron feature, at the same rotation phase. Our observations bear this out: In all cases we have found the 3micron band present on objects with a 0.7micron band at the same rotation phase.

Derived from text

Asteroid Belts; Water; Molecules; Silicates

20050202064 Johns Hopkins Univ., Laurel, MD, USA

Oxidation-Reduction in Meteorites: The Case of High-Ni Irons

Corrigan, C. M.; McCoy, T. J.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: In recent years, our research group has studied a range of asteroidal processes intimately linked to oxidation-reduction on meteorite parent bodies. These include the formation of oxide-bearing clasts on the aubrite parent body, melting of ordinary chondrites in the presence of graphite to understand the formation of primitive achondrites and the formation of vesicular basalts from the eucrite and angrite parent bodies by oxidation to form CO. Our most recent foray into oxidation-reduction and its influence on the formation of meteorites has been the study of high-Ni irons, specifically the Ni-rich ungrouped iron Tishomingo. While we have previously explored the role of fractional crystallization in the formation of high-Ni irons, this work specifically examines the role of oxidation.

Author

Meteoritic Composition; Oxidation; Iron; Nickel

20050202065 Open Univ., Milton Keynes, UK

High-Temperature Chemical Processing on Asteroids: An Oxygen Isotope Perspective

Greenwood, R. C.; Franchi, I. A.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Small planetary bodies accreted within 2.4 Myr of solar system formation. The primitive materials (CAIs, chondrules, matrix) incorporated into these asteroids were altered by a variety of secondary processes, including aqueous alteration, shock metamorphism, thermal metamorphism and melting. Here we look primarily at the role played by thermal metamorphism and

melting in altering the oxygen isotope systematics of asteroidal materials. Metamorphism and melting: Peak temperatures
Author
Asteroids; High Temperature; Meteoritic Composition; Planetary Evolution

20050202066 Japan Aerospace Exploration Agency, Kanagawa, Japan

The Hayabusa Asteroid Sample Return Mission

Yano, H.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: On 9th May 2003, the Japanese spacecraft MUSES-C was successfully launched from Uchinoura. The spacecraft was directly inserted into an interplanetary trajectory and renamed as 'Hayabusa', or 'Falcon', to be the first sample return spacecraft to visit a near-Earth asteroid (NEA).. The target is NEA (25143)Itokawa (formerly known as 1998SF36). Its size is 490 (100) x 250 (55) x 180 (50) m with a approx. 12-hour rotation period. It has a red-sloped S(IV)-type spectrum with strong 1- and 2-micron absorption bands, analogous to ordinary LL chondrites exhibiting possible space weathering effect [3]. The asteroid could be olivine rich compared to typical S asteroids. Assuming a bulk density of ordinary chondrites, the surface gravity of Itokawa is on the order of 10 micro-G, with an escape velocity = approx. 20 cm/s.

Author

Asteroid Missions; Chondrites; Gravitation; Olivine; Space Weathering

20050202067 Mount Holyoke Coll., South Hadley, MA, USA

The Spectral Properties of Angritic Basalts

Burbine, T. H.; McCoy, T. J.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: One type of material that tends to be relatively rare in our meteorite collections is basalt. Basalts are rocks rich in calcium-rich plagioclase feldspar and augitic pyroxene that form as solidified lava. One meteorite group, the angrites, is primarily basaltic in origin and make up 0.1% of all meteorite falls. These meteorites are composed predominately of anorthite, Al-Ti diopside-hedenbergite, and Ca-rich olivine. The type specimen, Angra dos Reis, is compositionally anomalous compared to other angrites since it is composed almost entirely of Al-Ti diopside-hedenbergite with only rare plagioclase.

Derived from text

Basalt; Calcium; Meteoritic Composition

20050202068 Arizona Univ., Tucson, AZ, USA

Correlation of Oxidation State with Thermal Metamorphism in Ordinary Chondrites

Marsh, C. A.; Lauretta, D. S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

All meteorites retain evidence of a heating event or events that occurred within the first few Ma of the appearance of the first solids in our solar system. In chondrites the degree of thermal alteration or metamorphism experienced is measured through a classification system called petrologic type. Heating of asteroids through the decay of Al-26 has been robustly studied and is generally favored as the heating mechanism for chondrite parent bodies. Induction heating has been proposed as an alternate heating source. While it has come under sharp criticism for requiring parameters that did not fit observations of T-Tuari winds, the induction heating mechanism has never been disproved.

Derived from text

Chondrites; Metamorphism (Geology); Oxidation; Induction Heating; Petrology

20050202069 Arizona Univ., Tucson, AZ, USA

A Chemical Model of Micrometeorite Impact into Olivine

Sheffer, A. A.; Melosh, H. J.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11493; Copyright; Avail: CASI; [A01](#), Hardcopy

Laboratory simulations of space weathering using laser irradiation have been successful in reproducing space weathering characteristics such as the reduction of olivine to form nanophase iron particles. However, the chemistry of the reduction of

Fe²⁺ in olivine to Fe metal has not been fully explored. We present a thermodynamic model of olivine undergoing post-impact cooling and decompression.

Author

Micrometeorites; Olivine; Hypervelocity Impact; Metal Particles

20050202070 USA House of Representatives, Washington, DC, USA

Space Weathering on Asteroids

Noble, S. K.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains black and white illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

‘Space weathering’ is a blanket term that is used to describe the processes and products by which physical and optical changes are incurred by a surface exposed to the harsh environment of space. Our understanding of space weathering comes almost exclusively from studies of lunar soils. The array of space weathering processes in the lunar regolith are illustrated. Derived from text

Asteroids; Space Weathering

20050202072 NASA Johnson Space Center, Houston, TX, USA

What is the Water (OH) Content of the E Asteroids?

Zolensky, M. E.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Attempts to match the E asteroids with enstatite-rich meteorites universally conclude that the aubrites or enstatite chondrites are natural candidates, and accordingly conclude that E asteroids as a class are very water-poor. Accordingly, the highly reduced nature of typical enstatite-rich meteorites suggests that aqueous alteration was an improbable process on any E asteroid. However, there are spectroscopic observations of several E-class asteroids that suggest the presence there of hydrated phases. Examination of the Kaidun meteorite reveals the true situation.

Derived from text

Asteroids; Chondrites; Enstatite; Moisture Content

20050202073 Washington Univ., Saint Louis, MO, USA

Oxidation/Reduction Processes in Primitive Achondrites

Benedix, G. K.; McCoy, T. J.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: Primitive achondrites are characterized by having a bulk chondritic composition and non-chondritic texture. They fall between enstatite and ordinary chondrites in mafic silicate compositions. They include the winonaites/IAB irons and acapulcoites/lodranites. Because of their unique textural and chemical features, the underlying goal of most studies of these groups is to understand the processes that modified chondritic bodies into fully-differentiated planetesimals (core, mantle and crust). Their intermediate oxidation state suggests either a significant role for oxidation/reduction during metamorphism and partial melting or a range of precursor oxidation states not fully sampled by chondrites. Here we discuss the relative influence of these processes on reduction/oxidation and suggest mechanisms by which these studies can be extended to asteroid studies.

Author

Achondrites; Crusts; Metamorphism (Geology); Meteoritic Composition; Oxidation

20050202074 National Museum of Natural History, Washington, DC, USA

Meteorite-Asteroid Links: Can They be Forged?

McCoy, T. J.; Burbine, T. H.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Born as scientific disciplines within six years of each other at the end of the 18th century, meteoritics and asteroid astronomy are intimately linked. Links between asteroids and meteorites satisfy both our basic curiosity as to the origin of these rocks and allow both communities to address the range of materials and processes operating during Solar System formation. In particular, identifying the parent asteroids for meteorites would elucidate compositional or thermal gradients present in the solar nebula. An excellent recent overview of meteorite-asteroid links is provided by [1] and is heavily

referenced here. I review the disparate datasets used by asteroid astronomers and meteoriticists, discuss the merits of several such links, and point to directions for future research.

Author

Asteroids; Meteorites; Meteoritic Composition; Planetary Evolution

20050203757 NASA Glenn Research Center, Cleveland, OH, USA

Progress of the Mars Array Technology Experiment (MATE) on the 2001 Lander

Scheiman, David A.; Baraona, Cosmo; Wilt, Dave; Jenkins, Phil; Krasowski, Michael; Greer, Lawrence; Lekki, John; Spina, Daniel; Landis, Geoff; 16th Space Photovoltaic Research and Technology Conference; May 2005; 6 pp.; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A02](#), Hardcopy

NASA is planning missions to Mars every two years until 2010, these missions will rely on solar power. Sunlight on the surface of Mars is altered by airborne dust and fluctuates from day to day. The MATE flight experiment was designed to evaluate solar cell performance and will fly on the Mars 2001 surveyor Lander as part of the Mars In-Situ Propellant Production Precursor (MIP) package. MATE will measure several solar cell technologies and characterize the Martian environment's solar power. This will be done by measuring full IV curves on solar cells, direct and global insolation, temperature, and spectral content. The lander is scheduled to launch in April 2001 and arrive on Mars in January of 2002. The site location has not been identified but will be near the equator, is a powered landing, and is baselined for 90 sols. The intent of this paper is to provide a brief overview of the MATE experiment and progress to date. The MATE Development Unit (DU) hardware has been built and has completed testing, work is beginning in the Qualification Unit which will start testing later this year, Flight Hardware is to be delivered next spring.

Author

Mars Surface; Solar Cells; Mars Surveyor 2001 Mission; Technology Utilization

20050203759 NASA Glenn Research Center, Cleveland, OH, USA, NASA Glenn Research Center, Cleveland, OH, USA

Progress of the Dust Accumulation and Removal Technology Experiment (DART) for the Mars 2001 Lander

Jenkins, Phillip; Landis, Geoffrey A.; Wilt, David; Krasowski, Michael; Greer, Lawrence; Baraona, Cosmo; Scheiman, David; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 248-252; In English; See also 20050203753; Original contains black and white illustrations; No Copyright; Avail: CASI; [A01](#), Hardcopy

Dust deposition could be a significant problem for photovoltaic array operation for long duration missions on the surface of Mars. Measurements made by Pathfinder showed 0.3 percent loss of solar array performance per day due to dust obscuration. We have designed an experiment package, 'DART', which is part of the Mars ISPP Precursor (MIP) package, to fly on the Mars-2001 Surveyor Lander. This mission, to launch in April 2001, will arrive on Mars in January 2002. The DART experiment is designed to quantify dust deposition from the Mars atmosphere, measure the properties of settled dust, measure the effect of dust deposition on array performance, and test several methods of clearing dust from solar cells.

Author

Mars Surface; Technology Utilization; Dust Storms; Mars Surveyor 2001 Mission

20050203799 NASA Glenn Research Center, Cleveland, OH, USA

Robotic Exploration of the Surface and Atmosphere of Venus

Landis, Geoffrey A.; [2004]; 1 pp.; In English; 55th International Astronautical Congress, 4-8 Oct. 2004, Vancouver, Canada Contract(s)/Grant(s): ECIS-3578; No Copyright; Avail: CASI; [A01](#), Hardcopy

Venus, the 'greenhouse planet', is a scientifically fascinating place. In many ways it can be considered 'Earth's evil twin.' A huge number of important scientific questions remain to be answered: 1) Before the runaway greenhouse effect, was early Venus temperate? 2) Did Venus once have an ocean? 3) What causes the geological resurfacing of the planet? 4) Is Venus still geologically active? 5) What is the 'snow' on Venus mountaintops? 6) Can we learn about Earth's climate from Venus? 7) Is the atmosphere of Venus suitable for life? To address these and other scientific questions, a robotic mission to study the surface and atmosphere of Venus has been designed. The mission includes both surface robots, designed with an operational lifetime of 90 days on the surface of Venus, and also solar-powered airplanes to probe the middle atmosphere. At 450 Celsius, and with 90 atmospheres of pressure of carbon-dioxide atmosphere, the surface of Venus is a hostile place for operation of a probe. This paper will present the mission design, discuss the technology options for materials, power systems, electronics, and instruments, and present a short summary of the mission.

Author

Venus Probes; Mission Planning; Spacecraft Design; Venus Surface; Venus Atmosphere

20050203800 NASA Glenn Research Center, Cleveland, OH, USA

Water on Mars: Evidence from MER Mission Results

Landis, Geoffrey A.; [2004]; 1 pp.; In English; 55th International Astronautical Congress, 4-8 Oct. 2004, Vancouver, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Viking and the Mars Exploration Rover missions observed that the surface of Mars is encrusted by a thinly cemented layer, or 'duricrust'. Elemental analyzes at five sites on Mars show that these soils have sulfur content and chlorine content consistent with the presence of sulfates and halides as mineral cements. The soil is highly enriched in the salt-forming elements compared with rock. Analysis of the soil cementation indicates some features which may be evidence of liquid water. At both MER sites, duricrust textures revealed by the Microscopic Imager show features including the presence of fine sand-sized grains, some of which may be aggregates of fine silt and clay, surrounded by a pervasive light colored material that is associated with microtubular structures and networks of microfractures. Stereo views of undisturbed duricrust surfaces reveal rugged microrelief between 2-3 mm and minimal loose material. Comparisons of microscopic images of duricrust soils obtain before and after placement of the Mossbauer spectrometer indicate differing degrees of compaction and cementation. Two models of a transient water hypothesis are offered, a 'top down' hypothesis that emphasizes the surface deposition of frost, melting and downward migration of liquid water and a 'bottom up' alternative that proposes the presence of interstitial ice/brine, with the upward capillary migration of liquid water. The viability of both of these models ultimately hinges on the availability of seasonally transient liquid water for brief periods.

Author

Mars Exploration; Mars Roving Vehicles; Water; Mars Missions; Viking Mars Program

20050203853 International Business Machines Corp., USA

Coordinates of the Five Outer Planets 1653-2060

Eckert, W. J.; Brouwer, Dirk; Clemence, G. M.; Astronomical Papers; 1951; Volume 12, pp. III-327; In English; No Copyright; Avail: CASI; [A15](#), Hardcopy

This volume contains the heliocentric coordinates of Jupiter, Saturn, Uranus, Neptune, and Pluto, at forty-day intervals from 1653 to 2060. They were obtained by numerical integration on the IBM Selective Sequence Electronic Calculator. These coordinates will be useful in discussing the motions of the planets themselves and in computing their effects on comets and other objects. All the mutual attractions of the five planets and the Sun were included and the resulting set of simultaneous non-linear differential equations of the thirtieth order was solved numerically with an accuracy of fourteen decimals. This accuracy is more than ample to give the desired accuracy at the two extremes of the four-hundred-year interval covered. The attractions of the inner planets, which are scarcely perceptible, can best be applied as small corrections to these values; their inclusion in the present data would have made them less convenient for the user. The relativity-effect, which is still smaller and is easily applied as a small correction, has also been omitted. The starting positions and velocities for the integration were determined from all the available observations. Approximately 25,000 observations from about 1780 to 1940 were used in the discussion. Two preliminary integrations were made to determine the constants for the final definitive one. The final integration was continued back to 1653 because observations of eclipses of Jupiter's satellites near that date are still of value. The present orbits represent observations extending over more than a hundred and fifty years within their probable error. Except for possible revolutionary improvement in the accuracy of observation, it will be many years before significant improvement in these orbits is possible. The immediate incentive for undertaking the work was the defectiveness of previous theories of Jupiter, Saturn, Uranus, and Neptune. Particularly in the case of Saturn, HILL'S Tables are now good to only five significant figures and will not long suffice for the most ordinary applications. Jupiter, Uranus, and Neptune are all departing from their predicted positions by increasing amounts. The coordinates of Jupiter and Saturn from 1653 to 2060 were taken from HILL'S Tables and compared with the present integration. The direct numerical approach to the problem has long been known but has been impractical in the past because of the magnitude of the numerical work. This volume of three hundred pages contains approximately one and one-half million figures, yet these constitute less than one per cent of those produced and temporarily stored in the calculator in the course of the integration. Over five million multiplications and divisions and seven million additions and subtractions of large numbers were performed by the machine. It should also be pointed out that the nature of the problem is such that a single error could render the entire calculation useless. Twelve million figures were recorded in punched cards for the discussion of the results and for use at other laboratories. The published data were transcribed from the cards in a form suitable for direct reproduction by the printer. The work was planned in detail by the authors jointly and executed by them or under their immediate supervision. The comparison with observations and the determination of the Y

Author

Coordinates; Jupiter (Planet); Saturn (Planet); Uranus (Planet); Neptune (Planet); Pluto (Planet); Correction

20050203987 NASA Glenn Research Center, Cleveland, OH, USA

Undercut Rocks at the MER Gusev Landing Site

Landis, Geoffrey A., et al.; [2004]; 1 pp.; In English; Geological Society of America Annual Conference, 7-10 Nov. 2004, Denver, CO, USA

Contract(s)/Grant(s): WBS 22-390-30-10; No Copyright; Avail: Other Sources; Abstract Only

On January 3 2004, the NASA Spirit rover landed on the plains inside the Gusev Crater in the southern hemisphere of Mars, and has made observations of the landing site and nearby region in visual and infrared wavelengths, as well as making in-situ measurements of rocks and soil. A number of rocks at the Gusev site are perched, with a significant undercut above the surface; additional rocks show a feature of being eroded or etched at a height of one to three centimeters immediately above the soil line. Some rocks also show terracing, and others show a two-tone pattern of albedo, with a distinct dividing line between a lighter area near the surface and a darker color above the surface. In a small number of cases, the dividing line is correlated with a visible horizontal groove in the rock, most likely indicating an earlier location of burial of the rock. A number of explanations for this undercutting are possible. Perched rocks can be placed on the surface by deflation of the soil from underneath the rock. The surface etching may be abrasion due to reptation. Reptation, or surface creep, occurs as sand moves without leaving the surface, as small (100-200 micron particles) moved by saltation set larger particles in motion. These large particles are effective at abrading the rocks at the surface level. The structure of 'ripple' features at the site is evidence to support reptation at the Gusev site. An alternate explanation is etching at the surface by chemically active grit.

Author

Mars Landing Sites; Rocks; Planetary Geology; Erosion; Soil Mechanics

20050203988 NASA Glenn Research Center, Cleveland, OH, USA

Teleoperation from Mars Orbit: A proposal for Human Exploration

Landis, Geoffrey A.; [2004]; 1 pp.; In English; 55th International Astronautical Congress, 4-8 Oct. 2004, Vancouver, Canada

Contract(s)/Grant(s): 22-319-20-B1; No Copyright; Avail: CASI; [A01](#), Hardcopy

For a human expedition to Mars, a case can be made that the best strategy for initial exploration is not to actually land the humans on Mars, but to put the humans into Mars orbit and operate on the surface by the technology of teleoperation. This will provide the results of human exploration, but at greatly reduced risk and cost. Teleoperation of Mars surface robots from a Mars-orbital habitat will operation near real time operation with minimum time delay, giving a virtual presence on the surface. By use of teleoperation, it is possible to vastly simplify the surface exploration mission. We now have no need to develop a human-rated Mars Lander and Mars Ascent Vehicle, and we can send geologists & biologists on the mission; not VTOL pilots. It is a cheaper, simpler, and safer way to explore, and hence it will be a faster way to explore. It has the excitement of being there, at a fraction of the price. Tele-exploration from Mars orbit also allows human (virtual) presence at a wide variety of locations. With an orbital base controlling surface telerobotics, human explorers are not stuck with one base location, but can explore all over Mars. They can explore the polar caps and also near-equatorial canyon regions, from the same orbiting base. This frees the mission from landing site constraints. With no need to select a 'grab bag' site that contains a large number of geologically diverse features at or near a single location; it is now possible go to all the best sites--paleolake sites, river beds, volcanic calderas, lava tube sites, layered terrain, canyons, possible shoreline features, the North and South poles. A near-polar inclination 24-hr 39-minute period Mars orbit, for example, will put the orbital station in line-of-sight of a given region for about 8 hours per day-- one teleoperation shift. Since present day life could exist on Mars, planetary protection is also needed to preserve the (possible) fragile Mars biosphere from competition from ferocious Earth life. Isolated biospheres on Earth have been devastated when they have been exposed to alien life forms introduced--accidentally or deliberately-- from another continent. If there is life on Mars, we will wish to protect it from having to compete with introduced Earth biota. Reverse planetary protection--protecting the Earth biosphere from exposure to Mars microorganisms--is also an important consideration. Exploring from orbit will reduce biological risk by keeping humans from exposure to possible Mars microbes. A telerobotic mission will need no quarantine on return to Earth, and avoids the difficult human question of how to isolate Mars mission astronauts infected by Martian microorganisms.

Author

Mars Missions; Teleoperators; Telerobotics; Mission Planning; Mars Surface; Habitats; Landing Sites

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20050202033 Texas Technological Univ., Lubbock, TX, USA

Solar Modulation of Inner Trapped Belt Radiation Flux as a Function of Atmospheric Density

Lodhi, M. A. K.; NASA Summer Faculty Fellowship Program 2004, Volumes 1 and 2; August 2005, pp. 17-1 - 17-20; In English; See also 20050202011; Original contains black and white illustrations; No Copyright; Avail: CASI; [A03](#), Hardcopy

No simple algorithm seems to exist for calculating proton fluxes and lifetimes in the Earth's inner, trapped radiation belt throughout the solar cycle. Most models of the inner trapped belt in use depend upon AP8 which only describes the radiation environment at solar maximum and solar minimum in Cycle 20. One exception is NOAAAPRO which incorporates flight data from the TIROS/NOAA polar orbiting spacecraft. The present study discloses yet another, simple formulation for approximating proton fluxes at any time in a given solar cycle, in particular between solar maximum and solar minimum. It is derived from AP8 using a regression algorithm technique from nuclear physics. From flux and its time integral fluence, one can then approximate dose rate and its time integral dose.

Author

Atmospheric Density; Inner Radiation Belt; Solar Activity Effects; Radiation Trapping; Terrestrial Radiation; Solar Cycles; Protons; Modulation

20050202048 NASA Johnson Space Center, Houston, TX, USA

Correlations of (Delta)O-17 with Chemical Characteristics Among Chondrite Groups

Mittlefehldt, D. W.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Original contains color illustrations; Copyright; Avail: CASI; [A01](#), Hardcopy

Demonstration of mass-independent O isotopic variations in solar system materials was a seminal discovery of meteoritics. These variations were thought to reflect incomplete mixing of O from different nucleosynthesis sources. Since then, two non-nucleosynthetic causes have been suggested: (1) differential photodissociation of distinct isotopomers of CO, enriching nebular gas in chemically reactive heavy O, and (2) gas-phase molecular reactions producing mass-independent O isotopic exchange. Nebular processes caused chemical fractionations that are observed in chondrite bulk compositions. If nebular processes also produced mass-independent O isotopic variations, then these may correlate with chondrite bulk chemistry.

Author

Oxygen 17; Chondrites; Vapor Phases; Meteoritic Composition

20050202052 NASA Johnson Space Center, Houston, TX, USA

Constraints on the Detection of the Solar Nebula's Oxidation State Through Asteroid Observations

Abell, P. A.; Gaffey, M. J.; Hardersen, P. S.; Workshop on Oxygen in Asteroids and Meteorites; [2005]; 1 pp.; In English; See also 20050202045; Copyright; Avail: CASI; [A01](#), Hardcopy

Introduction: Asteroids represent the only in situ surviving population of planetesimals from the formation of the inner solar system and therefore include materials from the very earliest stages of solar system formation. Hence, these bodies can provide constraints on the processes and conditions that were present during this epoch and can be used to test current models and theories describing the late solar nebula, the early solar system and subsequent planetary accretion. From detailed knowledge of asteroid mineralogic compositions the probable starting materials, thermal histories, and oxidation states of asteroid parent bodies can be inferred. If such data can be obtained from specific mainbelt source regions, then this information can be used to map out the formation conditions of the late solar nebula within the inner solar system and possibly distinguish any trends in oxidation state that may be present.

Author

Solar Nebula; Oxidation; Planetary Evolution; Asteroids

20050202087 NASA Glenn Research Center, Cleveland, OH, USA

Thin-Film Solar Cells on Metal Foil Substrates for Space Power

Raffaello, Ryne P.; Hepp, Aloysius F.; Hoffman, David J.; Dhere, N.; Tuttle, J. R.; Jin, Michael H.; [2004]; 1 pp.; In English; International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA; Copyright; Avail: Other Sources; Abstract Only

Photovoltaic arrays have played a key role in power generation in space. The current technology will continue to evolve but is limited in the important mass specific power metric (MSP or power/weight ratio) because it is based on bulk crystal technology. The objective of this research is to continue development of an innovative photovoltaic technology for satellite power sources that could provide up to an order of magnitude saving in both weight and cost, and is inherently radiation-tolerant through use of thin film technology and thin foil substrates such as 5-mil thick stainless steel foil or 1-mil thick Ti. Current single crystal technology for space power can cost more than \$300 per watt at the array level and weigh more than 1 kg/sq m equivalent to specific power of approx. 65 W/kg. Thin film material such as $\text{CuIn}_{(1-x)}\text{Ga}_x\text{S}_2$, (CIGS2), $\text{CuIn}_{(1-x)}\text{G}_x\text{Se}_{(2-y)}\text{S}_y$, (CIGSS) or amorphous hydrogenated silicon (a-Si:H) may be able to reduce both the cost and mass per unit area by an order of magnitude. Manufacturing costs for solar arrays are an important consideration for total spacecraft budget. For a medium sized 5kW satellite, for example, the array manufacturing cost alone may exceed \$2 million. Moving to thin film technology could reduce this expense to less than \$500 K. Previous work at FSEC demonstrated the potential of achieving higher efficiencies from CIGSS thin film solar cells on 5-mil thick stainless steel foil as well as initial stages of facility augmentation for depositing thin film solar cells on larger (6'x 4') substrates. This paper presents further progress in processing on metal foil substrates. Also, previous work at DayStar demonstrated the feasibility of flexible-thin-film copper-indium-gallium-diselenide (CIGS) solar cells with a power-to-weight ratio in excess of 1000 W/kg. We will comment on progress on the critical issue of scale-up of the solar cell absorber deposition process. Several important technical issues need to be resolved to realize the benefits of lightweight technologies for solar arrays, such as: monolithic interconnects, lightweight array structures, and new ultra-light support and deployment mechanisms. Once the technology has gained spaceflight certification it should find rapid acceptance in specific satellite markets.

Author

Photovoltaic Cells; Thin Films; Solar Cells; Metal Foils; Solar Arrays

20050203791 NASA Glenn Research Center, Cleveland, OH, USA

Solar Array Sails: Possible Space Plasma Environmental Effects

Mackey, Willie R.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 54-57; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

An examination of the interactions between proposed 'solar sail' propulsion systems with photovoltaic energy generation capabilities and the space plasma environments. Major areas of interactions are: Acting from high voltage arrays, ram and wake effects, V and B current loops and EMI. Preliminary analysis indicates that arcing will be a major risk factor for voltages greater than 300V. Electron temperature enhancement in the wake will be produce noise that can be transmitted via the wake echo process. In addition, V and B induced potential will generate sheath voltages with potential tether like breakage effects in the thin film sails. Advocacy of further attention to these processes is emphasized so that plasma environmental mitigation will be instituted in photovoltaic sail design.

Author

Solar Arrays; Space Plasmas; Environment Effects; Sails

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

20050201784 NASA Glenn Research Center, Cleveland, OH, USA

Floating Potential Probe Deployed on the International Space Station

Ferguson, Dale C.; Research and Technology 2000; March 2001; 2 pp.; In English; No Copyright; Avail: CASI; [A01](#), Hardcopy

In the spring and summer of 2000, at the request of the International Space Station (ISS) Program Office, a Plasma Contactor Unit Tiger Team was set up to investigate the threat of the ISS arcing in the event of a plasma contactor outage. Modeling and ground tests done under that effort showed that it is possible for the external structure of the ISS to become electrically charged to as much as -160 V under some conditions. Much of this work was done in anticipation of the deployment of the first large ISS solar array in November 2000. It was recognized that, with this deployment, the power system would be energized to its full voltage and that the predicted charging would pose an immediate threat to crewmembers involved in extravehicular activities (EVA's), as well as long-term damage to the station structure, were the ISS plasma contactors to be turned off or stop functioning. The Floating Potential Probe was conceived, designed, built, and deployed in

record time by a crack team of scientists and engineers led by the NASA Glenn Research Center in response to ISS concerns about crew safety.

Derived from text

Electric Potential; Plasmas (Physics); Safety Factors; Cracks; Deployment

20050203767 Synthetic Fuels Service, Inc., Largo, MD, USA

Effect of Stoichiometry on the Radiation Response of In(sub x)Ga(sub 1-x)As Solar Cells

Messenger, S. R.; Walters, R. J.; Summers, G. P.; Hoffman, R. H., Jr.; Stan, M. A.; 16th Space Photovoltaic Research and Technology Conference; May 2005, pp. 26-29; In English; See also 20050203753; No Copyright; Avail: CASI; [A01](#), Hardcopy

Several types of multi-junction (MJ) solar cells contain subcells made from ternary materials produced by the addition of indium and/or phosphorous to GaAs. The addition of indium tends to reduce the radiation response of GaAs cells, whereas the converse is true for phosphorus. Since the softer subcell usually determines the overall response of an MJ cell, it is important to examine exactly how quickly the addition of indium reduces the response of GaAs cells. We are concerned here primarily with the effect of proton irradiation on the n/p In(sub 0.22)Ga(0.78)As ($E_g = 1.1$ eV) solar cell fabricated by Essential Research, Inc. (ERI). This cell was designed to be the bottom cell of a high efficiency ($\sim 30\%$) InGaP(1.75 eV)/InGaAs(1.1 eV) MJ cell on a Ge substrate. We will compare these proton radiation results with those for an n/p In(sub 0.53)Ga(sub 0.47)As ($E_g = 0.75$ eV) solar cell fabricated by Research Triangle Institute (RTI), as well as with the single junction p/n GaAs/Ge solar cells. The RTI InGaAs cell, being lattice-matched with InP, was the choice for the bottom cell of an InP/InGaAs MJ combination.

Author

Stoichiometry; Proton Irradiation; Solar Cells; Radiation Damage; P-N Junctions; Indium Gallium Arsenides

20050203995 NASA Marshall Space Flight Center, Huntsville, AL, USA

Effects of Nuclear Interactions on Accuracy of Space Radiation Transport

Lin, Zi-Wei; Barghouty, A. F.; [2005]; 1 pp.; In English; Space Nuclear Conference 2005, 5-9 Jun. 2005, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Space radiation risk to astronauts and electronic equipments is one major obstacle in long term human space explorations. Space radiation transport codes have been developed to calculate radiation effects behind materials in human missions to the Moon, Mars or beyond. We study how nuclear fragmentation processes affect the accuracy of predictions from such radiation transport. In particular, we investigate the effects of fragmentation cross sections at different energies on fluxes, dose and dose-equivalent from galactic cosmic rays behind typical shielding materials. These results tell us at what energies nuclear cross sections are the most important for radiation risk evaluations, and how uncertainties in our knowledge about nuclear fragmentations relate to uncertainties in space transport predictions.

Author

Radiation Effects; Radiation Transport; Accuracy; Extraterrestrial Radiation; Predictions

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20050201921 NASA Langley Research Center, Hampton, VA, USA

Jim Starnes' Contributions to Residual Strength Analysis Methods for Metallic Structures

Young, Richard D.; Rose, Cheryl A.; Harris, Charles E.; [2005]; 27 pp.; In English; 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 18-21 Apr. 2005, Austin, TX, USA

Contract(s)/Grant(s): 23-762-55-TD

Report No.(s): AIAA Paper 2005-1876; No Copyright; Avail: CASI; [A03](#), Hardcopy

A summary of advances in residual strength analyses methods for metallic structures that were realized under the leadership of Dr. James H. Starnes, Jr., is presented. The majority of research led by Dr. Starnes in this area was conducted in the 1990's under the NASA Airframe Structural Integrity Program (NASIP). Dr. Starnes, respectfully referred to herein as Jim, had a passion for studying complex response phenomena and dedicated a significant amount of research effort toward

advancing damage tolerance and residual strength analysis methods for metallic structures. Jim's efforts were focused on understanding damage propagation in built-up fuselage structure with widespread fatigue damage, with the goal of ensuring safety in the aging international commercial transport fleet. Jim's major contributions in this research area were in identifying the effects of combined internal pressure and mechanical loads, and geometric nonlinearity, on the response of built-up structures with damage. Analytical and experimental technical results are presented to demonstrate the breadth and rigor of the research conducted in this technical area. Technical results presented herein are drawn exclusively from papers where Jim was a co-author.

Author

Residual Strength; Structural Analysis; Biography; Engineers; Metals

20050203975 NASA, Washington, DC, USA

NASA Strategic Roadmap Committees Final Roadmaps, Volumes 1 and 2

May 22, 2005; 438 pp.; In English; No Copyright; Avail: CASI; [C01](#), CD-ROM; [A19](#), Hardcopy

Volume 1 contains NASA strategic roadmaps for the following Advanced Planning and Integration Office (APIO) committees: Earth Science and Applications from Space; Sun - Solar System Connection. Volume 2 contains NASA strategic roadmaps for the following APIO committees: Robotic and Human Exploration of Mars; Solar System Exploration; Search for Earth-like Planets; Universe Exploration, as well as membership rosters and charters for all APIO committees, including those above and the following: Exploration Transportation System; Nuclear Systems; Robotic and Human Lunar Exploration; Aeronautical Technologies; Space Shuttle; International Space Station; Education.

CASI

NASA Programs; Project Management; Project Planning; Management Planning; Presidential Reports; Strategy

20050203976 NASA, Washington, DC, USA

NASA Strategic Roadmap Summary Report

Wilson, Scott; Bauer, Frank; Stetson, Doug; Robey, Judee; Smith, Eric P.; Capps, Rich; Gould, Dana; Tanner, Mike; Guerra, Lisa; Johnston, Gordon, et al.; May 22, 2005; 178 pp.; In English; No Copyright; Avail: CASI; [C01](#), CD-ROM; [A09](#), Hardcopy

In response to the Vision, NASA commissioned strategic and capability roadmap teams to develop the pathways for turning the Vision into a reality. The strategic roadmaps were derived from the Vision for Space Exploration and the Aldrich Commission Report dated June 2004. NASA identified 12 strategic areas for roadmapping. The Agency added a thirteenth area on nuclear systems because the topic affects the entire program portfolio. To ensure long-term public visibility and engagement, NASA established a committee for each of the 13 areas. These committees - made up of prominent members of the scientific and aerospace industry communities and senior government personnel - worked under the Federal Advisory Committee Act. A committee was formed for each of the following program areas: 1) Robotic and Human Lunar Exploration; 2) Robotic and Human Exploration of Mars; 3) Solar System Exploration; 4) Search for Earth-Like Planets; 5) Exploration Transportation System; 6) International Space Station; 7) Space Shuttle; 8) Universe Exploration; 9) Earth Science and Applications from Space; 10) Sun-Solar System Connection; 11) Aeronautical Technologies; 12) Education; 13) Nuclear Systems. This document contains roadmap summaries for 10 of these 13 program areas; The International Space Station, Space Shuttle, and Education are excluded. The completed roadmaps for the following committees: Robotic and Human Exploration of Mars; Solar System Exploration; Search for Earth-Like Planets; Universe Exploration; Earth Science and Applications from Space; Sun-Solar System Connection are collected in a separate Strategic Roadmaps volume. This document contains membership rosters and charters for all 13 committees.

Author (revised)

NASA Programs; Presidential Reports; Management Planning; Project Management; Project Planning; Strategy; Goals; Research Management; Space Exploration

20050204002 NASA, Washington, DC, USA

NASA Capability Roadmaps Executive Summary

Willcoxon, Rita; Thronson, Harley; Varsi, Giulio; Mueller, Robert; Regenie, Victoria; Inman, Tom; Crooke, Julie; Coulter, Dan, et al.; May 22, 2005; 348 pp.; In English; No Copyright; Avail: CASI; [C01](#), CD-ROM; [A15](#), Hardcopy

This document is the result of eight months of hard work and dedication from NASA, industry, other government agencies, and academic experts from across the nation. It provides a summary of the capabilities necessary to execute the Vision for Space Exploration and the key architecture decisions that drive the direction for those capabilities. This report is

being provided to the Exploration Systems Architecture Study (ESAS) team for consideration in development of an architecture approach and investment strategy to support NASA future mission, programs and budget requests. In addition, it will be an excellent reference for NASA's strategic planning. A more detailed set of roadmaps at the technology and sub-capability levels are available on CD. These detailed products include key driving assumptions, capability maturation assessments, and technology and capability development roadmaps.

Author

NASA Programs; Presidential Reports; Goals; Strategy; Summaries; Technology Assessment; Project Planning; Research Management; Lunar Exploration; Mars Exploration; Manned Mars Missions; Manned Space Flight; Project Management

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